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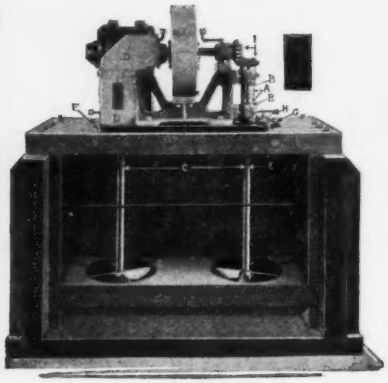

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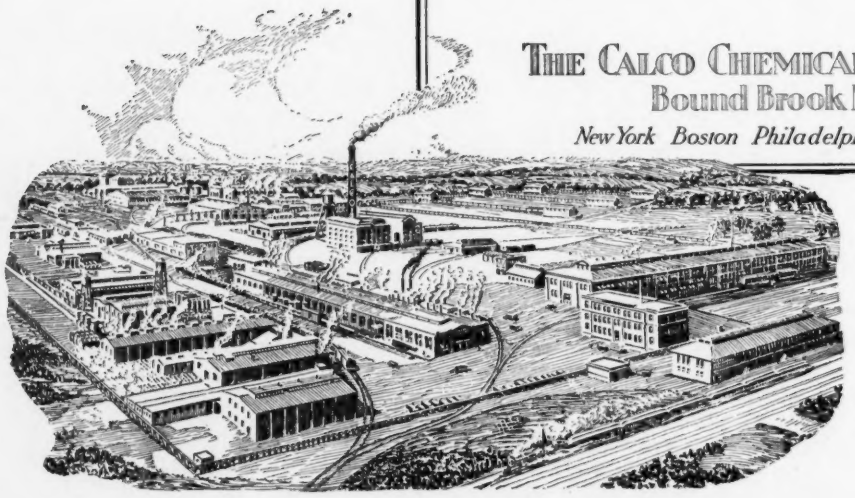

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VOLUME XIII NEW YORK, OCTOBER 6, 1924 NUMBER 17

Mercerizing: the Cotton Fiber and Its Luster

Modern Research Leading to Real Knowledge of What Happens in Mercerizing—Seat of Luster Is in the Individual Fiber—Effect Further Developed by Yarn and Fabric Structure—The Best Conditions—New Methods of Measuring the Amount of Luster Obtained

By CHARLES F. GOLDTHWAIT

[EDITOR'S NOTE—*This is a continuation of the article on mercerization which appeared in the last issue of The* REPORTER. *Part I was entitled "Mercerization—A Textile Romance," and treated the subject from the purely historical and commercial viewpoint. This second instalment deals with the technical phase of the process. Another instalment will appear in The* REPORTER *for October 20.*]

THE present review of mercerizing is based on the newer fundamental research work that has largely been carried out in England, and has less reference to the less recent work in the journals and the still older ideas that can be found in various books. Most of the older work has since been critically studied and extended, and in many instances the quantitative methods were not sufficiently developed to make the results reliable.

In seeking an explanation of the exact effects of caustic soda on cotton, and through this knowledge a better understanding of the mercerizing process, we are led deep into the mazes of physics and physical chemistry, although just now we shall touch only a few of the higher spots. Modern research has confirmed some old ideas and led to some new ones, but it has not yet brought about any revolutionary changes. There is, however, a certain satisfaction in knowing what has been accomplished, and always a chance that some new point will lead to an improvement or an economy in practice, because it is certain that all plants are not yet doing all their work in the best possible way.

The mercerization of a piece of cloth depends on the yarn and the construction of the fabric; the mercerization of yarn depends on the single fibers which compose it; the mercerization of any cotton depends on so many factors that the effects of changing a given condition cannot be thoroughly understood until the others are all known or under control. For this reason there is a great value in studying the mercerization of single cotton fibers, or cotton hairs as the British Cotton Industry Research Association prefers to call them. While very difficult to handle and measure, they offer the fewest complications when it comes to drawing conclusions.

Most mercerizing is done for luster or appearance, but it sometimes contributes other desirable properties to yarn or cloth. Single splicer yarns used in hosiery dye more uniformly with the lustrous two-ply yarn if they, too, are mercerized, although they show no luster. Higher tensile strength, diminished stretch and greater resistance to repeated stresses led to the manufacture of cotton airplane cloth when linen could not be obtained. Since these properties all have some importance and are more or less connected with ordinary mercerizing, they are included in our discussion and, in fact, have had a large share of attention in the original investigations.

LUSTER AND ITS CAUSES

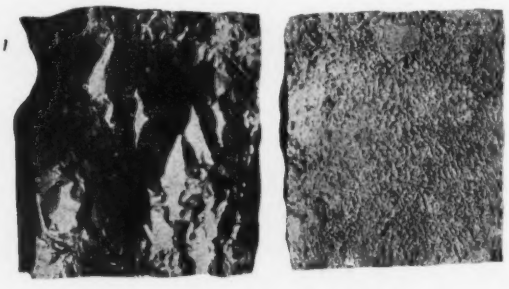
Since the object of most mercerizing is the luster, this is the most important phase of the subject. In considering it first it may seem that we have put the cart before the horse, the effect ahead of its causes. Luster, however, is not peculiar to mercerizing alone. Some cotton is comparatively lustrous without such treatment, and the better it is before the better it usually is after. Luster is a physical effect that can be produced by other means than mercerizing, so it can be discussed independently of the finer details of the process.

One's ideas on how to mercerize ought logically to hinge on his conception of the cause of luster, making it an especially important phenomenon to understand. Different writers have not entirely agreed on its cause, and there is still need of extended work to put the subject on a more definite basis. The best we can do is to present the more prominent views and show that in a general way they accord with present mercerizing practice.

Luster depends on reflection of light, and reflection of light depends on surfaces. However, plain reflection, as from a mirror, is not the whole explanation of luster in textiles, for it is not merely a question of the amount of light reflected [1] but largely of contrast between different parts of the surface which may present different angles to the source of light. This possibility is clearly shown by Fig. 1. Here A is a piece of crumpled tinfoil having dark and bright faces, while B is similar but excessively crumpled so that it approaches a rough surface. It reflects more light but is less lustrous.

This example is very interesting and suggestive, but is far from a complete explanation. First, it is necessary to distinguish between surfaces; the luster of piece goods depends upon the surface of the cloth, but the surface of the cloth is made up of the surface of cotton fibers. The tinfoil has but one kind of surface. The cotton fabric might be shown off to better advantage if arranged in some crumpled or other contrasting fashion, but still the separate threads in it are lustrous if removed and examined while stretched out straight, so the effect of the gross surface is to enhance but not to cause luster. The effect of contrasts must therefore be sought either in the separate strands of yarn or in the individual fibers.

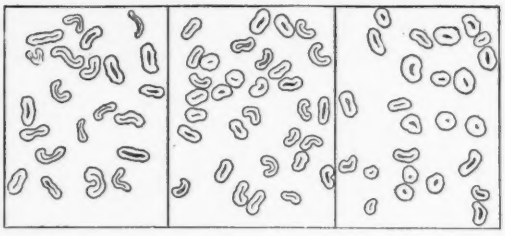
W. L. Balls, a leading British authority, speaking of unmercerized single cotton hairs, says that luster is probably almost synonymous with twist, an infinite number of convex surfaces each reflecting a spot of light. This effect is readily seen under the microscope on ordinary fibers, and even on fibers mercerized without tension. However, in addition there is refraction, which no doubt has considerable influence on the appearance, through the reflection of light back from the convex surfaces inside the fiber, the wall being necessarily translucent. While these observations probably apply only in part to mercerized cotton, which loses its twist in the process, they do appear to help explain its greater reflecting power, which may be due to an increase in transparency of the cell wall as well as to its changing in shape.



A *B*

FIG. 1—*Luster Demonstrated by Tinfoil*

Since neither silk nor artificial silk has fiber convolutions like cotton but have higher luster, the nature of the surface and the shape of cross-section are more likely the determining factors, this evidence strengthening views to be presented later.



Low-Luster Raw Cotton *High-Luster Raw Cotton* *Mercerized Cotton*

FIG. 2

EFFECT OF CAUSTIC ON FIBER SURFACE

The generally recognized effect of caustic soda on cotton is a change from the flat twisted-ribbon form to cylindrical, the more nearly circular cross-section sometimes serving as a means of distinguishing mercerized cotton.

The importance of shape is confirmed and emphasized by a very recent report by Adderly [14], who shows that the difference between non-lustrous raw cotton, naturally lustrous and mercerized depends on this difference in shape of cross-section. Such factors as fineness, length and convolutions have no connection with the degree of luster of unmercerized cotton, and therefore less influence than usually supposed in mercerizing.

The approach to a circular cross-section with increase in luster is shown very clearly in Fig. 2, where the mercerized cotton falls in as a part of the series; and since many of the latter fibers are still far from circular, it suggests that there is still room for improvement. Since mercerizing seems to represent merely a difference in degree, it is found that the more nearly the fibers are cylindrical or the more lustrous they are before mercerizing, the better will they be after.

Since the action is accompanied by swelling, many of the surface inequalities disappear and the washed and dried fibers retain this smoother surface and reflect light better than before treatment.

Luster of the fibers alone is not sufficient for good practical work, for they must be put into the yarn and fabric in a proper manner, and *this* construction prob-

ably brings in the effects of contrasts; for while the surfaces of the goods are smooth, they are really composed of small curved areas in infinite number, capable of reflecting light in different directions.

The more of these are arranged approximately parallel the better their reflecting power and the better the luster. The general principle of smoothness and parallelization is emphasized all through the preparation of yarn and cloth for mercerization. Combed and gassed yarns are best for warps and skeins, while fabrics featuring parallel threads, like sateens, give the best results in the piece. Sharp curvature of the yarn—i. e., crimp—in weaving tends to reduce luster; while flattening out, as in calendering, may develop a certain amount.

It might be thought that fibers of larger diameter having less curvature would contribute greater luster to yarns and fabrics, but any such tendency seems to be more than counterbalanced by other influences.

It is well known that hard water and similar deposits, as well as solid finishing materials, will detract from luster, while the Schreiner finish will sometimes add to it.

Best Yarn Twists

The degree of twist in yarn is one of the greatest determining factors. The higher it is the greater is the curvature of the fibers in their course around the axis of the yarn and the less smooth is the surface; that is, the more it approaches a physical rough surface. This is recognized to the extent that certain yarns are designated mercerizing twist.

An extended study by Corser and Turner [3] has given the most definite information up to the present on the effects of twist of the singles yarns and twist in the doubling on the properties of mercerized yarns. Yarns for mercerizing are usually spun as singles with the twist in a given direction, then doubled with the twist in the opposite direction. The angle at which the fibers cross the yarn and the extent to which they curve around the axis of the yarn, as well as their tightness, determine for a given cotton the yarn properties of strength, elasticity and appearance, as well as luster on mercerizing.

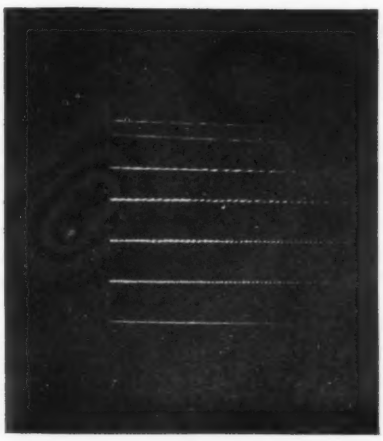


Fig. 3
Variations of Luster with Twist

Neglecting the other qualities for the present, the highest luster was obtained with the softening doubling twists, the twists of singles having less effect. Hard twists and soft twists in the singles, however, were not as good as the medium. The conditions outlined are those which leave the fibers in the yarn approximately parallel to the axis of the doubled yarn [4] [13]. In other words, the best luster is obtained when the fibers run lengthwise of the yarn instead of crossing it. In single yarns the individual fibers all cross at some angle, which affects the mercerizing results possibly as much as the fact that the twist does not hold the fibers so tightly. Doubling tends to throw them back parallel at the expense of some singles twist, but they are held very securely by the combinations of twists and do not slip badly under tension.

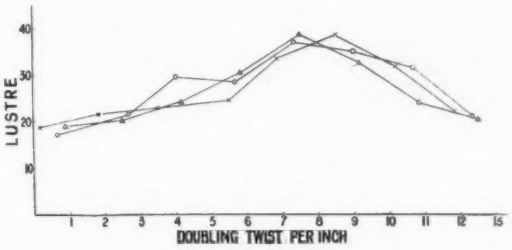


Fig. 4—*Variation of Luster with Twist*

Measuring the Amount of Luster

One of the great needs of the industry has been some definite measure of the amount of luster that has been obtained. Chemical tests for the degree of mercerizing have their uses, but are not a measure of luster. A carded yarn may have undergone exactly the same amount of action of the caustic as indicated chemically or by a dye test, but still have nowhere near the luster shown by a combed yarn. Luster is one of the most difficult properties to measure, but it has now been done with some degree of success [4] [13] [14].

To get suitable yarns for the investigation, measured amounts of twist were added to and subtracted from mercerized doubled yarns. This method can be criticized, as it does not entirely duplicate mercerizing practice where the proper twist is in the yarn at the start, and the absolute effect will be a little different. Such material is satisfactory for comparative luster measurements to develop a method. The prepared yarns were then evenly illuminated side by side, with the intensity of light falling off lengthwise of the yarn. A photograph showed the amount of light reflected by each, the intensity of the image and the distance that it projects to the right, both being measures of luster. In Fig. 3 it is clearly seen that the singles at the top are less lustrous than the two-ply; that the lowest and the highest twists have less luster, and that

the moderate twists, five to seven turns for this 3/2's yarn, are the best.

Another, a photometric, method was also devised to express the luster in figures. The result for the same 3/2 yarn is shown as a curve in Fig. 4 for three samples. The maximum is at eight turns per inch, a medium twist and in fair agreement with the previous method shown in Fig. 3. The luster is seen to rise to a maximum as twist is put in, and to then fall off again.

These two methods depend necessarily on the amount of light reflected; and while the view that light reflected is a measure of luster may not seem consistent with some of the theories of the cause of luster, the photographs, tinfoil and yarn, succeed in reproducing the lustrous appearance, so it seems that luster affects a photographic plate in very much the same way as it affects the eye. The second method which depends more directly on the measurement of a quantity of reflected light, is also very consistent with the photographs over a range of yarns.

Some such method would seem to have a practical mill application, as arguments and questions on the quality of luster are very common. Between these methods and the use of glarimeters and photometers for the measuring of luster or brightness of artificial silk, which is being developed in Germany at least, it may not be too much to hope soon for a definite practical method of measuring luster.

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(14) J. T. I. 15, T206.

The New Science of Colors

Conclusion

Bright Colors—The Measurement of Colors—The Harmonies—Practical Application of the New Color Science—Its Use in the Dyehouse

By WILHELM OSTWALD

Translated and Abridged by Albert P. Sachs, Technical Director, Universal Trade Press Syndicate

[EDITOR'S NOTE.—*This is the conclusion of the article on the Ostwald Color Theory that has been published in the* AMERICAN DYESTUFF REPORTER, *and with the other two forms a fairly complete discussion of the subject. For those who may desire to reread the others we give the references as follows: Classifying and Measuring Color by the Ostwald Method, by H. T. Tenen; Vol. 12, No. 4, page 127. A Simplified Method of Applying the Ostwald Color Theory, by Ismar Ginsberg, B.Sc., Chem. Eng.; Vol. 12, No. 23, page 809.*]

THE gray colors are now known. They are defined by the equation $w + b = 1$, where w is the content in white, b the content in black. Gray contains nothing but black and white, and their sum must equal 1.

The bright colors consist of a pure color, the quantity of which we may call f, and certain quantities of gray which are mixtures of white and black. Every bright color consists thus of a pure color plus white plus black. Hence, for bright colors f and $w + b = 1$. The number of pure bright colors is indefinitely large and their characteristic property is *hue*. What we call yellow, red, green, etc., is the hue. All hues have logically been arranged in a color circle, and these have been arranged in complementary pairs. Previous arrangements have claimed six or seven chief colors. The present circle shows there are really eight chief colors. The color circle has been divided into a totality of 100 colors numbered 00 to 99. At 00 we have sulphur yellow. We pass through orange shades to cinnabar red at 25, to bluer shades with ultramarine-blue at 50, and blue-green at 75. In this series the eight chief colors are yellow, orange, red, violet, ultramarine-blue, ice-blue, sea-green, leaf-green. Two complementary colors always differ by fifty on the scale. Thus orange 13 is complementary to ice-blue 63. The colors mentioned above are the ideal pure colors and contain no admixture of white or black. Actual colors always contain both. For any given hue a triangle w, f, b (Fig. 3), called the isochromatic triangle, is a complete representation of all colors containing that hue, as for every point in the triangle $f + w + b = 1$.

This triangle contains an indefinitely large number of points, each of which is a color. To simplify we divide the triangle by parallel lines into a series of parallelograms, within each of which the color is uniform and may be selected as that of the center. Fig. 4 shows the resultant isochromatic triangle.

If each of the eight chief color regions is divided into three we have twenty-four colors, a sufficient selection for all purposes. Twenty-four isochromatic triangles will thus cover the range of bright colors. The triangle shown contains gray only to the value p in the $a, c, e, g, i, l, n, p, r, t, v, x, z$ series; in the textile field, especially with wool and silk, it is possible to go to v. The triangles can easily be drawn to v or even z.

If the twenty-four triangles are so arranged that the gray sides w, b be along one axis, while the vertices f radiate therefrom and form a circle, we have the entire

rational body of colors (Fig. 5). If we consider it as continuous we have a double cone (Fig. 6), the upper vertex of which is white, the lower black, and the pure colors at the equator. The pure colors and white admixed form the upper sheet or surface, and pure colors and black the lower sheet. Pure colors admixed with gray form the interior of this sheet and are the *dull* colors. The axis is the gray series.

The Measurement of Colors

The measurement of colors is a problem the solution of which has led to a method which is simple in practice and consists essentially in determining the components

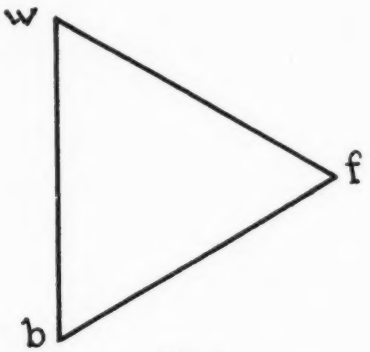

Fig. 3

w and b by observation through suitable color screens. Two complementary color screens and a gray comparison scale give us w and b. In the equation $f + w + b = 1$ we know w and b and the magnitude of f is determined. It is necessary to determine the *hue* of the color. By means of an instrument containing a Wollaston's doubly refracting prism and a Nicol polarizer, which enables us to get any value for f (i. e., the fraction of the total color which is due to the hue), so that equal intensities may be compared, we compare the given color with several which we judge to be its complement until a neutral gray is obtained by superposing the two images seen in the instrument. The color investigated is the complement of the one found to produce a neutral gray, and is found at fifty units off on the color circle.

The Harmonies

If one has impressed on his mind carefully what was said in section I about the gray harmonies, he is in a position to develop the bright color harmonies which are possible in the isochromatic triangle. It is only necessary to apply *the law of equal intervals* to the series occurring in the triangle to obtain harmonies of equal hue, which may be called hue-in-hue.

There are such series of three kinds. Parallel to the side $b\,f$ of the triangle are the series of equal white content, parallel to $w\,f$ the series of equal black content. There are, in addition, the perpendicular series, which are parallel to the side $w\,s$. These are the series of equal purity of color, or the *shadow series*. This name rests on the fact that they are the colors which are formed on a uniformly colored object illuminated from one side only; as, for instance, a garment.

The problem of constructing such shadow series occurs in painting every day. If we compare the shadows actually made in painting with the correct ones which both theory and experiment give, we can see how inaccurate the reproduction has usually turned out. But if, on the other hand, the correct shadow series is employed in such works the connoisseur is astonished at the unusual charm which it takes on.

Of the three kinds of series in the isochromatic triangle the shadow series is by far the most important, because we are continually seeing it in nature. Both other kinds are of less importance to us. Until now they were quite unknown, but one learns to know their peculiarities when he prepares them and studies them.

More important than the isochromatic harmonies are those in which different hues occur together. They are the only ones for which an attempt has been made to create a theoretical foundation; however, without any success. Every theoretician has, for instance, claimed that the complementary pairs formed harmonies, and every skilled practitioner comes to the conclusion that most such pairs are offensive. But if the complementary pairs are prepared optically (for instance, by doubly refracting crystals in polarized light) their beauty is overwhelming. How is this paradox to be explained?

It is explained by the fact that the hue is not the only element of the color but is merely one of three. Therefore, harmonies cannot be created based on the hues alone; in addition, both other elements must conform to certain laws. This is most completely the case in the equivalent circles in which white and black are constant.

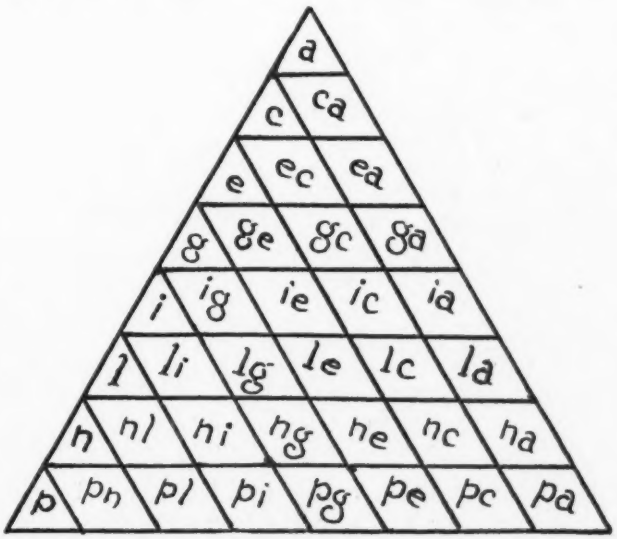

Fig. 4

If we place any two colors of the twenty-four in an equivalent circle together we have harmonious combinations, the effect of which, it is true, is of varying degrees of beauty, but none of them is unsightly.

Better, because more comprehensible, harmonies are obtained if we take colors the distances apart of which in the circle follow some simple law. By dividing the circle into halves, thirds, quarters, sixths, eighths, such comprehensible and impressive harmonies result in large number. Most of them are as yet unknown, because they become apparent only if we combine truly equivalent colors; differences in the white and black content destroy the effect completely. As a result, but few of them have heretofore been known, because we did not know how to prepare equivalent colors with any degree of certainty.

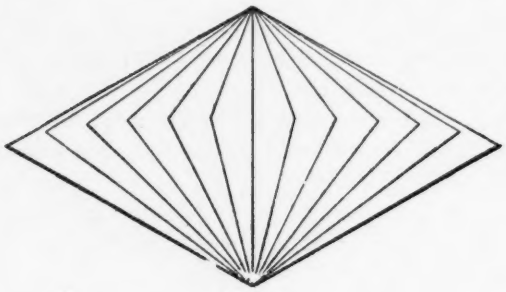

FIG. 5

From the equivalent and isochromatic harmonies are built up the harmonious color combinations with which the artist, the skilled artisan and, indeed, every producer of colored products can beautify his work. The number of possible harmonies is extraordinarily large. But they can be brought into an arrangement visible at a glance. In a separate work, "The Harmony of Colors," which in a few years has reached its fifth edition, I have described this arrangement and have placed every one in a position to create harmonious combinations in unrestricted variety.

PRACTICAL APPLICATIONS

The practical applications of the quantitative science of colors are so numerous and extensive that the field can at the present date be surveyed only in a very small part.* It must suffice, therefore, to present in this place only the most important points of view.

The technical significance of the science has three phases which may be distinguished by the words *measurement, arrangement* and *harmony*.

The significance of measurement of color lies in the fact that it makes possible the technical mastery of countless properties and procedures. As an example may be mentioned the characterization of a dyestuff. Formerly we knew of Methylene Blue only that it dyes wool blue and has high tinctorial power. Now we are able to say that it produces hue 54 or the second ultramarine, and that in the proportion of 1:2,000 it gives the depth of color L. All properties to be considered in the practical application may be expressed by exact figures and the dyer can calculate the costs and the yields of his art with a certainty of which he formerly had no inkling. What has been said for the dyer applies for every other mode of application. It is known to me that a firm which manufactures printing inks by measuring the dilution curve of its black found that it could add a large amount of a cheap admixture without appreciably diminishing the depth of color. It produced great savings in this manner without any detriment to its customers. By measurement of the cleaning which a dirty fiber obtains by the use of various cleansing media, the quantitative value of these cleansers can be determined. And in every field where optical phenomena play a part important applications of the measurement phase of the science of colors may be named or foreseen.

The second great phase of application is *arrangement*. It has already been noted that until the present in no collection of colored objects, be it a catalogue or dyestuffs stock, paper samples or knitting yarns, porcelain colors or millinery, has it been possible to arrange rationally with respect to colors. Consideration of the color globe shows the explanation for this. It indicates that we must base the arrangement either on the equivalent circle or on the isochromatic triangle; that there is no possibility at all of spinning out an unbroken continuous thread of colors from the dye globe as one would from a ball of yarn. In order to arrive at a line or arrangement we must necessarily introduce a twofold arrangement in which new series are begun at intervals. I know that these suggestions are without meaning for those who have not immersed themselves more deeply in the problem. The suggestion has been made only in order to show that the old problem has finally been solved in fact. An opportunity may present itself later to investigate this more closely. At this point it must suffice to point out that we are at present able to arrange the totality of colors coherently and comprehensively so that everyone who knows the simple fundamental laws can find the desired color in its proper place in a few moments. The existence of the large color atlas of 2,500 colors which I issued

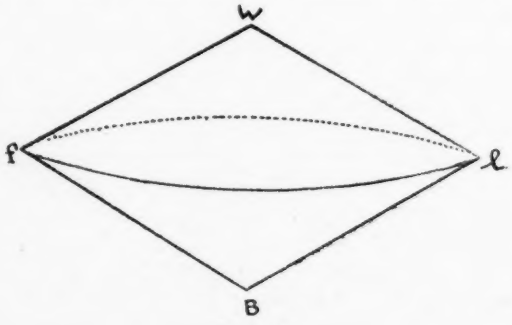

FIG. 6

*At the end of 1923 the Wilhelm Ostwald Colors Company, Inc., of 32 Potsdamer Str., Berlin, was founded with the technical application of the new science of colors as its object.

in the years 1917 and 1918 proves this claim objectively to everyone who has seen it. It appears even more clearly from the standard atlas, the publication of which has just begun.

What gain of time and efficiency is to be obtained in this manner can readily be imagined by onyone who, for technical or scientific reasons, has been faced by the hitherto unsolved problem of arranging rationally a great number of colors. To name only one example, I may point to the work of the dyer in the textile industry. The most frequent problem with which he comes in contact is to match the color of a given sample of yarn, cloth, wool, etc. Until the present he has been thrown back on the resources of his own experience and memories, which permitted him to guess with what dyestuffs and with what quantities he could attain his objective approximately. Then began a period of testing and modifying, until perhaps only after several days did he achieve success. The dyer of the future will determine in a minute by comparison with his standard atlas what the number of the color of the sample is. He will look up in his formula book, under the same number, what formula he has found or obtained for this particular color, and can proceed without any delay to the actual dyeing. All the time-and-money-consuming testing and modification will disappear in the future. The dyestuff manufacturers will soon find themselves induced to determine the coloring properties of their new dyestuffs so accurately in accordance with the standards that it will be possible without difficulty to calculate how to make up a dye bath in any given case.

I should not dare to present this picture if I had not daily made the discovery that it is in fact really so. The color samples which accompany my published works are determined according to the standards. If the colored paper corresponding to a color is used up or if new combinations are necessary I need only consult my formula book and can have the desired color prepared at once, and accurately. In the last few months I have prepared the color standards on *artificial silk* and the ladies of my acquaintance are using the wonderfully beautiful material with delight for knitting. I do not at all need to keep a stock of several hundred spools of the dyed silk, for I can with the aid of my book prepare any color desired in a quarter of an hour so exactly that it cannot be told from the previous lot.

Finally, in the matter of *harmony*, the important point of view has already been indicated. What formerly was the rare product of a special artistic gift, or what was the result of gradual development from a tradition hundreds of years old—namely, the creation of color harmonies affecting pleasantly the eye—has now become a thing which anyone can learn, like the multiplication table or bicycle riding. It has therefore become possible to have harmonies radiate beautifully not only from rare masterpieces, which are available only to the few, but to use them for every colored object whatsoever, from a lady's hat to a skyscraper, from an ocean steamer to a child's toy.

THE SOUTHERN TEXTILE EXPOSITION

The Sixth Southern Textile Exposition in Greenville, S. C., will open on October 20. Exhibits are already being installed. All of the spaces have been marked off and the booths erected. All space has been sold in both the main building and the annex.

The annex will be very attractive; painters are now giving the interior a coat of eggshell white. It is well lighted. Being only 48 feet from the main hall, it is practically part of the hall.

A battery of power-driven sewing machines have been at work in the building for several weeks preparing the decorations, which will be unusually attractive.

The exhibits this year will be the most interesting ever staged in Textile Hall. Many machinery and equipment ideas of special interest will be shown for the first time. Not only should manufacturers of yarns and cloth feel that it is necessary for them to attend in order to keep informed as to new inventions and improvements, but those interested in knitting and hosiery mills, worsted and silk plants, and dyeing, bleaching and finishing of textiles will find a great deal to interest and instruct them. Students in textile and allied industries will be welcome.

This exhibition will be 60 per cent larger than any ever held in the South. The machinery manufacturers have taken more space this year than they have ever engaged before. They are not only putting out a complete line, but they are introducing for the first time some new ideas and inventions which have been held back especially for this show.

It is realized that the South is a great new field for textile development. This exposition has been advertised for two years, and will be visited by more executives, superintendents, overseers and operatives than many other expositions along the Eastern coast.

The committees are composed mainly of textile representatives; most of them have had experience at previous expositions. They are making extraordinary preparations to receive exhibitors and visitors.

At Bradford, R. I., it is understood, the Bradford Dyeing Association is planning to rebuild the portion of its three-story building, used as a storehouse, which was recently burned with a loss estimated at approximately $100,000.

Production has been started at the plant of the American Cellulose & Chemical Manufacturing Company, Ltd., at Amcelle, Md. It will be some weeks before the fiber is on the market in a commercial way, according to Dr. Camille Dreyfus, president of the company, although the early results are satisfactory, and he considers that the quality of the initial output is at least up to the standard of the British Celanese that has been selling here since the first of the year. The American Celanese will be marketed on the same price basis as the British.

Soaps and Alkalies in Fulling

The Actions That Take Place in a Fulling Mill—Shrinking Agencies—The Part Soap Takes in Fulling —Comparison of Kinds of Soap Used

By A. W. DAVISON, Ph.D.

Professor of Physical Chemistry, Rensselaer Polytechnic Institute, Troy, N. Y.

IT is universally agreed that so far as finishing room operations are concerned, the process of fulling plays an extremely important part in determining the quality and appearance of the finished product. The actions which take place in a fulling mill are frequently understood only by the finisher. It seems advantageous, therefore, to discuss this important process briefly for the benefit of those who are interested in the manufacture and use of woolen fabrics, but whose connection with the industry is outside the finishing room.

Three simultaneous processes take place in the fulling mill: felting, shrinking, and washing. Wool is one of the very few textile fibers which possess the ability to felt, or matt together. This ability is due to the presence of overlapping scales on the outer surface of the fiber. Under the action of heat, pressure, friction, and such softening agents as hot water, dilute acids and alkalies, the scales are caused to open sufficiently to permit those of one fiber to interlock with those of a neighbor, thereby forming a close union of the fibers. Wool can be caused to felt in hot water, by pressure, but if it is desired to secure a maximum amount of felting, as is done in the manufacture of hat felt, dilute acid would be used as the softening agent. In finishing cloth, however, it is not desired to secure anything like the maximum amount of felting, and soap solutions have been found to possess just the right amount of softening power for this class of work.

Shrinkage Agencies

Every housewife is familiar with the tendency of wool to shrink during the laundering process. She knows that to have the woolen garments maintain their original shape and size, she must avoid certain definite practices in washing them. The use of extremely hot water, strong soaps, or soaps containing free alkali, and excessive rubbing, must all be avoided. Obviously, if one deliberately sets out to shrink a fabric, he will make use of such agencies as those avoided by the housewife, enumerated above. We are not surprised, therefore, to find that soap, alkalies, friction, and heat are the agencies through which the shrinking process is accomplished.

Although fulling mills are not run primarily as washing machines, there takes place in them nevertheless a very decided cleansing action. Many of the oils and greases which have been added to the fiber at various stages of manufacture to render it less harsh and brittle, and to facilitate spinning and working it, are emulsified by alkali and soap in the fulling mill, and are in condition to be removed in the cloth-washing process which follows the fulling operation. Obviously, ordinary dirt which has accumulated on the fabric during manufacture is also emulsified by the soap.

The Part Soap Takes in Fulling

Having analyzed the three distinct actions which take place in a fulling mill, we are impressed with the important role which soap plays in each case. There is one additional very important function performed by the soap; that of lubricating the fabric during the milling operation. We have seen that pressure, friction and heat are required in the process. The pressure and friction are obtained mechanically by means of heavy wooden rolls through which the cloth is passed, and at certain stages of the process, by means of a squeeze-box, or trap, through which the cloth is forced under regulated pressure, as it comes from the rolls. This passage through the rolls and trap takes place many times, the piece, usually one bolt in length, has its ends sewed together, so that it forms an endless belt, which runs through the rolls and trap as long as man be required to produce the desired finish, weight and shrinkage. The time of running may be anything from less than one hour to several hours, depending upon conditions. The friction developed by this action liberates sufficient heat to bring the cloth to the required temperature. So great is this friction that, were it not for the lubricating properties of the soap, sufficient heat would be generated within the fabric to injure it severely.

It is highly important that just enough, and not too much, soap be supplied to the piece during the fulling. If too little soap is used, two very serious faults will develop: the washing function will not be properly performed; and the tensile strength of the fabric will be materially lowered by the high temperature and excessive chafing resulting from insufficient lubrication. Occasionally a soap will be encountered which will function properly for thirty minutes or so, and will then break down, lose its lathering power, cause the goods to heat, and permit the dirt and grease which was once emulsified to set again in the piece. Under these conditions, goods may be ruined very quickly. The operator may, however, discover that the soap has broken down before physical damage is done to the stock. He will invariably find that the grease has "set," and that it is well-nigh impos-

(Continued on page 656)

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DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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DYES AS A BUSINESS BAROMETER

SOME day, some wise economist or statistician will decide that dye sales are a good business barometer, and will set the figures alongside of check transactions, new buildings, crops and the various other measures of prosperity, or of the vacuum that it leaves behind.

It is well known that statistics of widely used service or widely used commodities—referring, of course, only to necessities—serve as a measure of general business activity, and often give an insight into the future. The consumption of dyes must similarly reflect business conditions rather closely; and while such figures, which would be the real measure, could not be obtained, dye sales should answer the same purpose.

Business moves as a unit. Next in importance to agriculture, and iron and steel, we have textiles, one of the greatest industries of the whole country; and, incidentally, it includes a good share of agriculture, for cotton and wool are domestic farm products.

The textile mills are the greatest users of dyes, and textiles rise and fall with business. In fact, a single branch, the carpet trade, is often considered a good business indicator. Rugs and carpets are a necessity, but under some circumstances their purchase will be postponed, while in better times more and more expensive ones will be bought. Clothing and the great variety of textiles used in making automobiles and in the other mechanical arts rise and fall with general business. Dyes go parallel with them.

Dyes find a multitude of other uses. Paper is a large item, and the use of colored paper is widely distributed. Dyes enter into paints and kindred products used in the household, the building trades and in a great variety of manufacturing. No doubt the many minor uses of dyes will tell the same story, for they comprise shoe polish, toilet soap, printing inks and many other items of quite universal use.

The mere characterization of the manufacture of dyes as a "key industry" is sufficient evidence of its importance. Perhaps further consideration by the public and by the Government could be obtained if the dye industry should become known as of sufficient importance to serve for a measure of general business prosperity.

GUARANTEED FASTNESS

THE textile manufacturer who guarantees his fabrics to be fast to light, washing and other color-destroying agents brings out an important selling point, one which buyers of those fabrics are quick to recognize as essential to large retail sales of certain classes of dry goods. Several fabric advertisements appearing in a current issue of a well-known dry goods publication are built around such fastness guarantees. First, the trade-marks of the fabrics featured in these advertisements are words cleverly coined to express the fact that the material is fast, non-fading wash goods. Concise phrases used in describing the goods further exemplify this "fastness" idea conveyed by the trade-mark, as "sunproof," "fast color fabrics," "wash fabrics," "tubproof," "fast to everything." The descriptions of the different voiles, satines, draperies and prints advertised emphasize the fastness of the fabric, above wear, finish and beauty. One advertisement features the fastness guarantee in a panel beside the text of the main message, thus: "Guarantee: If any E—— fabric fades, for any reason, you are authorized to refund to your customer not only the purchase price of the material but the making cost of the garment as well." These sales messages are intended for the buyers of retail dry goods and department stores.

The makers of these fabrics evidently use excellent dyes. It is highly probable that a great majority of them are American dyes. Some of them are probably imported colors; but from dye consumption and production figures shown by the last dye census, it is unlikely that all of the manufacturers who are guaranteeing the fastness of their fabrics use imported dyes, as only 4 per cent of the dyes used here are imported.

The point we wish to bring out is this: If the fabric manufacturer can guarantee the fastness of his prints, ginghams and draperies, then the manufacturer of the dyes used on those fabrics must be in a position to guarantee his dyes. Would it not aid *both* if the textile manufacturer, in his fastness guarantee, in his advertising, were to quote the guarantee of the *dye* manufacturer? In doing this the fabric advertisement need not mention the name of the company that manufactures the dyes used. If it merely brought out the fact that the dyes being guaranteed for fastness are American-made the benefit to the American dye industry would be inestimable.

The fabric manufacturer would benefit as well. His own fastness guarantee would be backed up by the guarantee of the dye manufacturer. By mentioning that the dyes he uses are made in this country and that they are *guaranteed* by those who make them to be fast to wash-

ing and to light, he would create a popular demand for American colors. Increased demand means lower distribution and manufacturing costs, and consequently lower dye prices. It would probably be the higher-priced quality dyes that would thus become popular, and volume sales of these would contribute largely to the maintenance and expansion of our dye industry.

This suggestion, we believe, deserves some consideration from both the dye man and the textile man, for it is based on a plan of definite co-operation.

Things Every Textile Chemist and Colorist Should Know

[*Note—Under this heading there is being published, as a more or less regular feature, the discussion of certain fundamentals which should be a part of every textile chemist's and colorist's working knowledge. It is hoped that such discussions will instruct and interest some of the younger readers, and serve as a review for those of broader experience and knowledge.*]

No. 13—Testing Silk

SPEAKING of the testing of silk usually calls to mind the well-known fact that the moisture content of silk can vary from a few per cent. up to thirty without the silk feeling wet. We usually think of silk testing and "conditioning" as being nearly synonymous. In the purchase of silk, and in setting a fair price for it, the amount of moisture should be taken into account; but this test tells nothing whatever about the manufacturing properties of the silk.

Equally if not more important are the various defects and quality tests, for at times far greater loss may result from silk that works badly or that has not been properly selected for a specific purpose than from silk containing a few extra per cent. of moisture. Again, while silk is sold by grades, it has come to pass that these grades do not mean much, partly because they vary from season to season according to the degree of success or failure of the silk crop, and partly because they have been stretched to cover silks that are not quite up to grade. Then, too, intermediate grades have been introduced and different people have somewhat different systems of grading, and the result is a quite confused state of the whole matter.

Therefore, the manufacturer who wishes to know what he is buying has to test the raw silk himself, and the moisture test is but a very small part of the work or of the value of the tests to the user.

The application of the tests can most easily be seen by a brief review of the method of preparation of raw silk. Silk comes in cocoons of, roughly, 500 to 1,000 yards in length, but the single strand is too fine and delicate to pass directly into textile manufacturing. Therefore, the required number of cocoons, usually five to seven, are floated on a pan of warm water and then reeled off together, new ones being joined on as fast as the first ones run out. Raw silk consists of skeins of these composite threads, and one of the first requirements is that their filaments shall be firmly united. This property is especially important to weavers and dyers, and is measured by the cohesion test. While there is still much to be desired in the conduct of cohesion tests, the American machine invented by Warren P. Seem has been adopted as a standard by the Silk Association of America.

The silk is rubbed under standardized conditions and graded according to definite relations between the number of strokes and the number of threads that open up or split into their constituent strands.

Silk of poor cohesion causes particular trouble by opening under the friction of the reeds, etc., in weaving, giving a hairy fabric.

Dyeing also depends upon cohesion, in that a silk of poor cohesion is liable to split up and become hairy in degumming and dyeing. Lousiness, which is fundamentally caused by minute bunches of fibrillae which do not take dyes like the rest of the silk, may depend somewhat upon the lack of cohesion, but is a more fundamental defect. Silks that are high in both strength and cohesion do not become lousy unless through harsh or excessive treatment. Silks not as high in these qualities may become lousy and should have special tests.

Owing to the nature of the process, a great deal of unevenness may result in the raw silk by ends running out and not being properly pieced up, or by two or three new cocoons being started on at once. Often thick or thin places run for a good many yards and lead to light and heavy streaks in weaving and barber-pole effects in stockings.

One check on this quality is the sizing test, but since it is made on either 225 or 450 meter lengths there is a tendency to automatically average the defects; and while a series of tests does give a wide range, the extreme variation is not shown. A variation between 11 and 17 on a silk that is supposed to average 14 denier is practically normal, and the heavier is over 50 per cent heavier than the fine. Much greater variations are encountered over short lengths and are shown up by the serimeter and the gauge tests, mentioned later.

Other sources of trouble are the so-called cleanness defects, such as waste twisted around or entangled in the threads; bad casts, which are heavy threads where the filaments were not properly pieced up; large knots; split threads, where the individual filaments have become separated; loops where one or more filaments have become slack in running and have been carried into loops pro-

jecting from the main thread. There are other classes of defects, but the above are typical, and they are important because they make heavy places in threads, as well as hairy and otherwise defective goods.

Certain standards have been drawn up for the numbers of such defects that are allowable in different grades of silk. They can be seen and judged by inspection of the skeins and by winding the silk onto black cards. The more recent method is the gauge test, where the strands of silk are run through fine steel slits, according to size, and the more serious defects will catch and can be counted.

Strength and elasticity (or elongation) are important and are measured by the serigraph, a recording tensile strength machine, or, together with evenness, by the serimeter where the tests are made on single strands. Tenacity and elongation are not essentially different in their measurement and interpretation from the similar tests on other textiles. Since threads are selected for testing which show no obvious defects, the evenness can be judged from the strength, which should theoretically be proportional to the size of thread. Converting the strengths to equivalent size will give a range in deniers from six or seven to over twenty for silk that is supposed to run fourteen. In other words, the heavier threads may be over three times as heavy as the lightest. Regardless of how many yards these defects may run, they are very serious where evenness is necessary for perfect work.

The boil-off test and special tests for residual soap and oils are similar in purpose to the tests for excessive oil and grease in wool.

There are also tests for "hand," color, luster and fragrance, which have an influence on judging the quality, as well as for winding.

While some inspectors grade silk on the basis of visual inspection with reference to its visual characteristics, there is a growing tendency to rate raw silk on the basis of the most important tests which can be made on machines and can be conducted with reasonable consistent results in different laboratories. These main tests are strength, cohesion, evenness and cleanness, and on these properties, more than on anything else, depend the selection of silk for different purposes and its value for manufacturing.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part VII

Beam Dyeing Machine—Its Operation—Advantages—A Horizontal Machine—Operation—Bleaching Process—Dyeing Operations—Advantages of the Plant

By RAFFAELE SANSONE

The Beam Dyeing Machine

THE beam dyeing machine is of importance for producing bright colors with substantive or direct dyestuffs. Through its means the frailest fabrics can be treated without suffering any damage, being dyed even in the most delicate shades with comparatively little work on the part of the dyers, especially if one of the best plants is used in which all charging-in and taking-out operations can be conducted with the assistance of an overhead crane worked by chains and running on an upper rail. The different plants to day at disposal for dyeing cotton cloth on the beam can be divided into two principal groups:

1. That comprising machines in which the spread material is entered and treated in a horizontal position, and

2. That where it is entered and treated in a vertical position.

The machines of both groups give excellent results if properly worked. So far, however, those of the first group have found the greater favor and application, especially as many dyers wish to keep the material under their observation all through its treatment, to be in a position to correct any mistake made before it is too late. A type of machine working on a similar principle is indicated in Fig. 1.

This shows a perfected form of machine containing two shallow dye vats (A and B) constitute of copper-plated iron, of a special iron alloy, or, if the works can afford it, entirely of copper. From such vats the dye bath or any other bath can be run out by the action of a special circulation arrangement (C), the principal portion of which consists of a powerful centrifugal pump worked by a small electric motor, gas engine or steam engine. The baths are delivered either to one of a series of cisterns serving for the preparation of the baths, or directly through four beams of cloth (M) fitted just above vats A and B on a low double iron framing (P and Q), and return again to the vats in the form of a shower and so keep up a continuous circulation through the plant.

The beams for the cloth are constructed in an ingenious way, being made from a metal that is in no way affected by any chemical or dye liquor used in the dyehouse. They are no heavier or bulkier than an ordinary wood-section beam and cannot get damaged

through rough handling, being filled on special machines where the cloth can be wound to any degree of hardness required for the dyeing; for in beam dyeing, as in any other method of dyeing, different qualities of cloth behave differently in the dye bath, and also different colors require different treatment. For assisting the dyeing operations the beams of cotton cloth

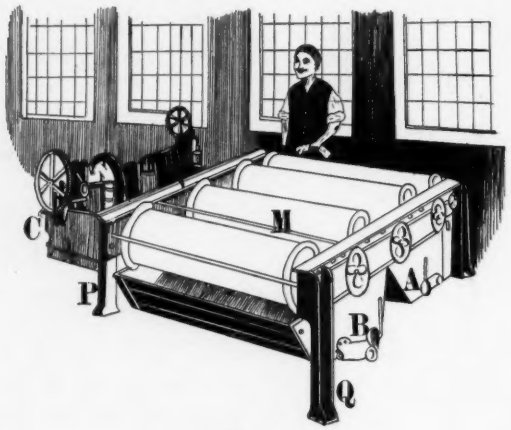

FIG. 1

are turned on their axes while the bath is being circulated. A cement collecting cistern is placed below the plant for the bath after the dyeing operations, and from here the bath can be pumped out to one of the upper preparation vats.

THE WORKING OF THE PLANT

The work on the above plant being thoroughly different from that on the jigger or continuous dyeing machine, a special training is at first necessary to obtain the best results. A method of carrying out the process would be as follows: The dyers fill uniformly one beam after the other, carrying onto a special frame back of the dyeing plant to enter one by one on frames P and Q. Here they fix the beams at one side against the tube that is to lead the dye bath into the perforated central portion and at the other side to the fixing and turning cones, which also keep them in position.

When the above operations have been accomplished, the dyers pass steam through the goods by opening a small tap on the circulation pump and prepare their treating bath in one of the upper vats already indicated, delivering this bath by its own gravity to the dyeing plant and to the cloth on the beams, stopping its passage when vats A and B have been filled to a certain height. At this point the circulation arrangement (C) is put in motion to pass the same bath through the material repeatedly and the beams are caused to turn on their axes.

In this way the dye bath is gradually exhausted so far as possible and to the degree allowed by the color itself, the dyeing being initiated at the heat of the solution coming from the preparation cistern or vat, which is later heated further through the entrance of steam in long copper coils contained in vats A and B. Should in this way the desired intensity of shade not yet be reached a fixed quantity of a salt solution of known strength is introduced in vats A and B in small quantities at a time, continuing the dyeing at as high a temperature as possible and completing it in the cooling bath, if the nature of the colors allow it. Sometimes additions of soap or soap and phosphate of soda are made to the dye bath from the start. In this case, however, additions of the salt solution are left out toward the end of the dyeing, as light or medium shades are generally desired as bright as possible.

Once the desired shade has been produced as above, the dyer, while still allowing the circulation pump to run, draws off the dye bath from vats A and B, closing then the drain cock and entering water in vats A and B, from where it is pumped by the circulation system M and passes over and over again through the material, depriving this of the greater part of the mechanically fixed coloring matter. At a certain point in the rinsing the stopcocks of vats A and B are opened to let off the colored water into the waste water main, increasing the speed of the running water entering to keep the vats always filled.

In this way all mechanically fixed dyestuff is eliminated and the material on the beams is prepared for the drying. This is conducted by stopping the centrifugal pump and sending warmed air under pressure through the perforated centers of the beams, prepared in a small separate apparatus. This soon brings the cloth to the desired degree of dryness, which is regulated in accordance with the nature of the finish it has to possess later, being generally left well filled with moisture when it has to be hot-Shreinered to produce a permanent silk finish. The drying completed, the beams are lifted from the plant and delivered to the finishing and packing room. A new lot of material rolled on other beams is then entered in the plant.

THE ADVANTAGES OF THE PLANT

A plant constructed as above offers many advantages to the dyer of bright colors, among which may be mentioned:

1. The work of a four or six beam plant can be entrusted to one dyer, with or without an assistant.

2. By careful management, and by weighing the material on all beams, only just what dye bath is necessary to produce the desired shade can be prepared and used.

3. When several lots are to be dyed in the same shade, prepare just what dye bath is necessary for treating the first lot, strengthening this each time after its running out of the dye vats and using it for the following lots.

4. The percentage of color to be employed for the

coloring of each bath can be regulated by an able colorist from the laboratory if he has at disposal a small beam dyeing machine for conducting his dyeing trials.

5. The machine works entirely automatically, and once the beams are placed in it the dyeing, rinsing and drying processes can be conducted without any further handling of the cloth.

6. No streaky or uneven dyeing takes place, as penetration is most perfect in every particle of the fiber, which is thus evenly dyed, and not plastered on the outside as sometimes takes place in chain dyeing.

7. The matching of the dyeings is rendered easy and reliable by the dyer's taking at any time a cutting from the cloth being dyed on the different beams.

8. The rotation given to the beams causes gravity to act uniformly on the dyed cloth while this is being dyed or rinsed.

9. Should it be required, by starting a second centrifugal pump on the plant two of the beams can be employed for the bleaching operations, while the other two are employed for the dyeing, or two beams can be employed for one color and two beams for another.

Another Type of Horizontal Machine

Another type of horizontal beam dyeing machine, with which rather large volumes of cloth can be dyed in one color, is shown in Fig. 2.

This shows a large cylindrical iron boiler B of a suitable iron alloy to resist the action of alkalis and acids, one end of which is closed by a semi-spherical wall, while the other is quite open and can be closed by a round door, indicated by D, and which by an upper lifting arrangement (L) can be taken away completely at one side of the boiler itself, leaving this quite free at the front. A special arrangement here allows the running out on rails, to any desired portion of the works, of a large iron construction or carriage (C) fixed on four solid iron wheels and sustaining a special arrangement through which a large roll of cotton cloth can be run continually in the dye bath between two perforated beams. Only one of these is turned at a time by the assistance of an internal arrangement worked from without by shaft S and motor M when the iron carriage is in boiler B.

A powerful rotation pump (P) forces the bath through tube *t* below a special case (*m*), delivering it at the top by tube T and sprayer Z, while passing a portion of it also through the perforated shafts or beams winding and unwinding the cloth by an arrangement at one side, allowing the passage also through the cloth. Tube *t* has two taps (*c* and *d*), opened or closed by an iron key. Tap *c* serves in this case for the outlet of the baths or of rinsing water through tube *z*, while tap *d* serves for delivering the bath entering by tap *c*, or from the bottom of boiler B by tube *t* to the circulation pump P. Tube T has also a tap (*r*) and two connections (*a* and *b*) with which water or the dye bath can be introduced. The bath can be heated when required by entering steam in a long closed coil placed in case *m*.

The Working of the Plant

The operation of working the above plant would also require a certain training before being accomplished with full success. When the plant must be worked to the fullest efficiency—that is, for boiling out, bleaching and dyeing cotton cloth—the dyers first wind on one of the beams to serve for the winding operations, the lot of material to be treated, forming two high rolls one after the other, each containing, if possible, the same number of pieces; and when this has been accomplished they enter the filled beam on the iron carriage, already indicated, which contains another empty perforated beam, to which is fixed the beginning of the cloth coming from the said roller; the iron carriage is then introduced into boiler B, closing the door of same.

The ends of the perforated beams thus come in contact with the turning arrangement and motor M is put in motion to start the turning of the empty perforated shaft, bringing onto this automatically and little by little the two rolls of cotton cloth. When this has been done, the centrifugal pump P is started and a malt solution is introduced and circulated continuously through the material to render soluble the size present, this being later run off and followed by the circulation of hot condensed water. A weak bath of caustic soda is next circulated through continuously for several hours, and then withdrawn to introduce another alkaline bath, if necessary, or cold water for a long

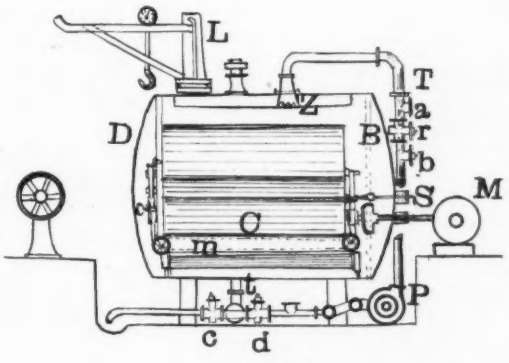

Fig. 2

rinsing, causing this to enter and escape very rapidly in the closed plant without any heating, and continuing the treatment until the drain waters are no longer alkaline.

During all this time the cloth is rolled between the two perforated beams, the direction of its rolling being inverted each time one of the perforated shafts has nearly been completely emptied by the pulling action

exerted by the cloth itself, this arrangement and the continual circulation of the different baths through the material while in a rolled and unrolled condition allowing every portion of the surface of the cloth to come in contact with the dye bath, being completely freed of its impurities.

The Bleaching Operations

When the second rinsing operation has been completed, a bath of hypochlorite of soda measuring from ¼ to ½ deg. Be. is introduced and caused to circulate for a certain time; withdraw it after this and replace it by another bath of the same product if the desired white has not yet been produced. During this operation, to assist the action of the hypochlorite, air under pressure is introduced in the interior of boiler B, closing off all issues and creating a certain pressure.

After the production of the desired white a third rinsing with clean cold water is made to follow, eliminating, however, the pressure in the interior of boiler B and continuing the treatment until all hypochlorite has been expelled, a weak bisulphite of soda or sulphuric acid bath being then passed through the goods, following with a fourth rinsing, the last water of which is rendered slightly alkaline with a little old caustic soda bath. The cloth is then ready for the next treatment.

The Dyeing Operations

These are started by introducing the dye bath by tap *r*, prepared at the back of the plant, in one of a series of copper or iron copper-plated tanks heated by steam and worked by mechanical agitators. The dye bath thus comes in strong contact with the cotton material while this is running from beam to beam, passing through this with great rapidity and being sprayed on it from all directions, so that even if the whole of the interior of boiler B is not filled the material is evenly treated all through, being brought to the required shade very soon; this can be rendered darker also in this instance by entering steam in the copper coil and by carefully adding salt solution. Do not cause a too rapid precipitation or salting out of the coloring matter on the material, or the inner portions of the rolls of cloth will be dyed darker than the outer.

Advantages of the Plant

The above plant offers several marked advantages, some of which are indicated below:

1. Two rolls of cloth can be boiled out, bleached and dyed without requiring any intermediate handling on the part of the operatives.

2. Owing to the continual movement of the material in the bath and to its continual circulation, even shades can be produced on the thickest fabrics and on velvets and plushes.

3. The special arrangement of the plant, allowing the entrance of air under pressure, permits the carrying out of all bleaching and dyeing operations under more rapid conditions when carried out in the open air and with greater likelihood of a thorough and rapid penetration.

4. By increasing or reducing the size of boiler B the production can be brought higher or lower, the turning shafts being constructed to carry three or more rolls of cloth. Two pairs of perforated turning beams may be used simultaneously.

5. The possibility of running the supporting carriage C in and out of boiler B permits, by means of rails on the outside of the plant, the charging of the goods in the gray room and their treatment and delivery to the drying department without requiring any lifting or lowering operations on the part of the dyers, who have simply to push the carriage of material back and forth.

6. The entrance of air under pressure, through the opening of a tube at the top of the boiler for the discharge of all vapors and the passage of steam through the heating coil, also allows the expulsion of all water and the drying of the material by simply starting pump P, saving a later treatment of the cloth on the drying cylinders or hot-air drying machine.

7. The bleaching operations, so far conducted under ordinary atmospheric pressure, can take place in the above plant under a much stronger pressure, facilitating the action of the bleaching agent and much reducing the tendering generally taking place.

(*To be continued.*)

SOAPS AND ALKALIES IN FULLING

(*Concluded from page* 650)

sible to start it again by the addition of more soap. In such cases, free alkali in the form of ammonia, soda ash, or pearl ash is effective in again starting the grease.

When too much soap is used in fulling cloth, there is no difficulty with the washing function, but there is great difficulty in securing the desired shrinking effect. This is due to the fact that there is too much lubrication, and as a consequence, sufficient heat is not developed in the goods to cause shrinkage.

Formerly, soap was introduced into the goods by pouring it on the piece, after the latter had been placed in the mill. The judgment of the operator was the sole criterion as to whether the right amount of soap had been added. In modern practice, soap is added to the piece outside the fulling mill, in a special unit known as the soaping machine. This machine may be adjusted to apply just the right amount of soap, in a thoroughly uniform manner, and by its use, soap troubles in the fulling mill have largely been eliminated.

Comparison of Kinds of Soap

Opinions seem to differ, with respect to the type of soap to be used in fulling. These differences refer more

to the alkali in the soap, than to the fat or oil. Some authorities state that potash soaps have much more beneficial effect upon wool fiber than do the corresponding soda soaps; that soda tends to render the fiber harsh and brittle, and that it tends to impart a yellowish color to the stock, whereas potash tends to produce a soft, perfectly white fiber. Potash soaps are true soft soaps; soda, hard. Potash soaps are somewhat more expensive than those made from soda. Soft soaps can be made from soda, by introducing sufficient water, but this practice is plainly adulteration. Unscrupulous soap dealers have at various times preyed upon the woolen industry by disposing "soft" soaps, made from soda, with water added, and representing them to be potash soaps. Mill operators were not slow in detecting the presence of this large amount of water, and in realizing that they were paying a fancy price for a commodity which they might draw from any tap in the establishment. As a result of such experiences, many mill operators have condemned all soft soaps as frauds, while the truth of the matter is that a true potash soft soap, containing no water, can be, and is, made by reputable manufacturers. A mill operator may protect himself against fraud, in the purchase of soft soaps, in two ways: by purchasing his soap only from reputable manufacturers and dealers, and by subjecting his purchases to chemical analysis.

Either potash or soda soaps may be made from animal fats, fish oils, or vegetable oils. Animal fats are not quite satisfactory for making potash soaps and formerly fish oils were used, but soaps made from these substances were never free from objectionable odors, which would cling to the wool. Modern hardening processes have rendered these fish oils odorless, and we now have excellent potash-fish-oil soaps, which do not have any of the old, objectionable odor. Vegetable oils are to-day the most satisfactory, and widely-used sources of fat for making fulling soap. Either potash, or soda soaps, properly made from these oils, can be depended on to hold body during the fulling operation.—The Hunter Bulletin.

DR. HERTY REVIEWS DYE PROGRESS

American dye exports now reach 18,000,000 pounds annually, while to-day fully 96 per cent of American consumption is being supplied by the domestic industry, according to Dr. Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers' Association of the United States, who in a report of progress to the American Chemical Society asserts that in nine years "a modern miracle has been worked."

"It is difficult to give accurately the capitalization of the industry," says Dr. Herty, "for in many cases it is impossible to decide what part of the capitalization of a company should be apportioned to that side of its activities represented by the manufacturers of dye products."

United States quality is fully equal to that of foreign products, he declares, and prices show a steady reduction. Research has been an important factor in the development of the last two years, he reports.

"Through a process of survival of the fittest, the number of manufacturers engaged in this work has now become pretty nearly constant," Dr. Herty continues. "The motley crowd which rushed into the field because of the enormously high prices with the great demand for products regardless of quality has been reduced to a substantial group of companies varying from the small manufacturer of two or three specialties to the largest with the most varied assortment of offerings.

"One of the most striking developments of the last few years has been the constant improvement in the quality of the products. It should be a false pride which would deny the inferior quality of many of the products manufactured in the early days of the industry.

"While it is true that many of the troubles experienced in 1916 and 1917 were due to the wrong use of dyes, both American and left-over German stocks, nevertheless fairness compels the statement that many of those American products were extremely faulty in their quality. To this point our manufacturers have given their especial attention, knowing that in the long run quality must decide.

"To-day consumers throughout the country bear willing testimony to the fact that the quality of American dyes fully equals those of foreign manufacture, and in many cases is better.

"There is probably no better illustration of the healthy working of government protection than this industry affords, for it has received special protection from Government authorities, both administrative and legislative, because of the realization of the bearing of this industry on economic independence, national defense and public health.

"Those who early predicted that the industry would soon show a consolidation into a few large units, or perhaps one great unit in imitation of German organization, missed their guess. The spirit of the Sherman anti-trust law has been kept inviolate.

"The industry, spurred on to intensive efforts to cheapen the cost of production and improve the quality of the products, has constantly advanced, and it is a just claim that consumers have gained the full benefit of these advances, for the Tariff Commission has been able to report each year a reduction in the average price per pound of dyes made in America."

NEW DU PONT BLACK

E. I. du Pont de Nemours & Co. announce placing on the market a new diazotizable black—Pontamine Diazo Black VX. It represents a product used freely pre-war, producing shades of exceptional brightness when diazotized and developed with Pontamine Developer T Extra. Coupled with beta naphthol the shade produced is bluer. It is offered as being of particular interest for half-silk hosiery, where it gives a bright black of even depth on both fibers. The product is soluble and dyes evenly, making it suitable for all classes of cotton goods, raw stock, yarn, pieces, etc., and for machine dyeing, being particularly fast to light, washing and perspiration. It is discharged with sulphoxylates.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

FAST BROWN R
(Schultz No. 214)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool and silk.

USUAL METHOD OF DYEING: Acid.

SHADE: Reddish brown.

SOLUBILITY: Good.

LEVEL: Does not dye level.

FASTNESS TO:
Acid: Fast.
Alkali: Fast.
Carbonizing: Fast.
Fulling: Bleeds badly into white wool and white cotton.
Light: Changes shade on seven days' exposure.
Potting: Bleeds badly.
Rubbing: Rubs slightly in heavy shades.
Steaming: Fast.
Sulphur: Fast.
Washing: Scours off badly, losing in depth.

ON UNIONS: Cotton-effect threads are stained. Silk-effect threads are stained.

COMPETING PRODUCTS: Made in the United States under name of Fast Brown R by Central Dyestuff & Chemical Company (Selling Agents, H. A. Metz & Co.).

PALACHROME RED G
(Schultz No. 224)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool and silk.

USUAL METHOD OF DYEING: On wool, with Glauber salt and acetic acid. On silk, with boiled-off liquor and sulphuric acid.

SHADE: Yellowish red.

SOLUBILITY: Not good; use a lot of hot water.

FASTNESS TO:
Acid: Fast.
Fulling: Fairly fast on wool.
Light: Fast.
Washing: Very good on silk.

DYED BY OTHER METHODS: Dyes wool also from a neutral bath.

ON UNIONS: Wool-silk unions: With sulphuric acid, both fibers dyed about equal.

DISCHARGING: Discharges white with zinc.

COMPETING PRODUCTS: Made in the United States under under name of Palachrome Red G by Palatine Aniline & Chemical Works (Selling Agents, F. E. Atteaux & Co.).

BRILLIANT CROCEINE
(Schultz No. 227)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Bright scarlet.

SHADE BY GASLIGHT: Yellower.

SOLUBILITY: Good.

LEVEL: Dyes level with care.

EXHAUSTS: Clear.

PENETRATION: Not good.

FASTNESS TO:
Acid: Fast.
Alkali: Fairly fast to ammonia; not fast against soda.
Carbonizing: Fast.
Cross-Dyeing: Not suitable for cross-dyeing.
Fulling: Not fast; stains white cotton and white wool.
Ironing: Fast.
Light: One of the best of the acid reds.
Perspiration: Fairly fast.
Potting: Bleeds badly.
Rubbing: Fast.
Scouring: Not fast; stains white wool and white cotton.
Steaming: Fairly fast.
Sulphur: Moderate; shade goes yellower and lighter; bleeds a little.
Washing: Not fast; bleeds badly into whites.
Water: Not fast; bleeds with Markischer test.

SENSITIVE TO METALS, LIME: Very sensitive to copper.

DYED BY OTHER METHODS: Top-chromed, shade very slightly dulled. Wool is dyed fairly well in a neutral bath.

ON UNIONS: Wool-silk unions: Both fibers dyed to the same depth in an acid bath.

ON OTHER MATERIALS: Cotton and artificial silk threads are not stained when wool is dyed with sulphuric acid. Paper: Suitable; add to the unsized pulp; good affinity for all pulps. Typewrite ribbons: Suitable. Silk: Dyed with

boiled-off liquor and sulphuric acid, fast to light; not fast to water or washing; suitable for weighted or pure silk. Cotton: Dyes a full shade with alum and Glauber salt.

PRINTING: Suitable for wool and silk printing.

DISCHARGING: Discharges white with sulphoxalates or with tin salts or zinc dust.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.); Central Dyestuff & Chemical Company; E. I. du Pont de Nemours & Co.; National Aniline & Chemical Company; Sherwin-Williams Company; Commonwealth Color & Chemical Company; American Aniline Products, Inc.; Grasselli Dyestuff Corporation; Newport Chemical Works.

PONCEAU 5R
(Schultz No. 228)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Bluer than S-249.

SHADE BY GASLIGHT: Yellower.

SOLUBILITY: Good.

LEVEL: Does not dye level, except with great care.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast.
Alkali: Color is sensitive to alkalis.
Carbonizing: Shade returns on neutralizing.
Fulling: Bleeds badly into whites and shade goes yellower.
Ironing: Fairly fast.
Light: Good fastness; fast enough for ladies' dress goods.
Potting: Not fast; bleeds.
Rubbing: Fast.
Scouring: Not fast; bleeds badly and shade changes.
Steaming: Fast.
Sulphur: Very fugitive.
Washing: Not fast; bleeds badly into whites.
Water: Bleeds with Markischer test.

ON UNIONS: Cotton-effect threads are left white in an acid bath. Silk-effect threads are stained in an acid bath.

ON OTHER MATERIALS: Cotton: Dyed with alum and Glauber salt. Silk: Dyed with boiled-off liquor and sulphuric acid; fast to light. Jute: Dyed with alum; suitable for burlap. Paper: Add to the unsized pulp; good affinity for all pulps; fast to light.

DISCHARGING: Discharges white with tin or zinc.

COMPETING PRODUCTS: Made in the United States by Central Dyestuff & Chemical Company.

SUDAN IV
(Schultz No. 232)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Dyes cotton-padded with beta naphthol and developed with amido azo toluene a Bordeaux red.

SHADE: Bordeaux red.

FASTNESS TO:
Acid: Fast against acetic acid. Shade is changed by mineral acids.
Alkali: Fast.
Chlorine: Fast.
Ironing: Altered shade returns on cooling.
Light: Same as Sudan III.
Rubbing: Crocks badly.
Steaming: Fast.
Washing: Bleeds off slightly.
Water: Bleeds.

ON OTHER MATERIALS: Used for coloring varnishes and oils. Fast to light.

PRINTING: Can be used in calico printing.

DISCHARGING: Discharges white with hydrosulphite.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; Central Dyestuff & Chemical Company; Cincinnati Chemical Works; Commonwealth Color & Chemical Company; National Aniline & Chemical Company; Newport Chemical Works.

CLOTH RED B
(Schultz No. 233)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Acid, top chrome, bottom chrome and chromate. Top chrome is best.

SHADE: Bluish red, bluer than S-234.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Good.

LEVEL: Dyes level only with care; not a shading color.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast to organic acids.
Alkali: Fast.
Carbonizing: Fast when top-chromed.
Fulling: Bleeds badly into white wool and white cotton.
Ironing: Slightly yellower.
Light: Very good top-chromed.
Potting: Bleeds.
Rubbing: Crocks slightly.
Steaming: Fast when top-chromed.
Washing: Bleeds into whites slightly.
Water: Not fast to salt water; stains whites.

SENSITIVE TO METALS, LIME: Sensitive to copper and iron; the shade is duller.

(Continued on page 662)

Technical Notes from Foreign Sources

New Process for Color Discharge on Indigo-Dyed Fabrics

The new process consists of a combination of the leucotrope process, for making the indigo background, with the potash-rongalite printing process for the Indanthrene dyes. This combination is suited for use without any further changes in the regular indigo discharge process. It is also reported that there are no difficulties present in obtaining blue and green colors in accordance with this method of working. It is, however, impossible to obtain a clean yellow in this way, and in this respect recourse is again had to vat dyeing of the discharge spots in an alkaline bath with after-reoxidation of the indigo.

When the leucotrope process is carried out in the proper manner, the indigo on the printed spots on the fabric is completely changed into soluble, sulphated benzyl indigo white. This is accomplished in the steaming apparatus. These white places are then no longer suitable for dyeing by the vat process. For further details see Textilberichte, 1924.

Electroconductive Dyestuffs

According to a German report, electroconductive dyestuffs have been on the market for some time. They are used in printing. For example, the Merten color consists of a metal powder which is made from Wood's alloy and mixed with printer's dye. This dye is, however, very sensitive to heat, which is a great disadvantage, as the electric current increases the temperature. Better dyes of this kind have recently been made according to the process of George von Hassel, where the electroconductive colors are produced by the so-called fritter action. According to this process, dyes of a graduated conductivity can be produced. When metal powder is exposed, for example, to electric waves, the separate grains are fritted together or melted, and in this way the resistance which the loose metal powder grains offer to the passage of the electric current is increased. By means of these fritted dyes the conducting coating is produced.

Indigo Sol

Indigo sol is a new form of indigo. It is the sodium salt of the sulphuric acid-enol ester of indigo white. The preparation of the substance is accomplished by treating leuco indigo with sulphur trioxide in the presence of tertiary bases in absence of air. The substance, which is soluble in water, is very resistant to light, acids and alkalies in its aqueous solutions. However, it is immediately changed back into indigo by the action of weak oxidizing agents.

As this dyestuff does not possess direct affinity for vegetable fibers, it is suitable for use in slop-pad dyeing. The colors that are produced in this way are also very stable. Indigo sol is suited as well for the production of smooth, discharged colors and also for direct printing.

There are two ways in which slop-pad dyeing and printing can be carried out. In the first process, sodium nitrite is added without any oxidizing agent and the development of the color takes place in a sulphuric acid bath. In the second process an oxidizing agent is added and the color is developed by steaming.

The slop-padded colors can be made to possess resist properties by the use of suitable reagents, such as sodium thiosulphate, rongalite, sodium hydrosulphite, and the like. The possibility of resist dyeing with the aid of vat dyes and the fast azo color of the rapid fast red type is of particular importance, as in this manner a very fast dyed material can be obtained.

Similarly, direct printing with the indigo sol is considerably simpler and good results are more certain than when indigo itself is employed according to the usual methods that are in common practice. Indigo sol blue colors are characterized by complete penetration of the color and by better fastness to rubbing than the usual indigo vat colors.

Furthermore, indigo sol is also very important for wool dyeing, although no more important than it is in the case of cotton dyeing. Indigo sol, when used in the dyeing of woolen fabrics, is mixed with acetic acid and formic acid, and after the fabric has been placed in the dye liquor the temperature of the bath is gradually raised until it reaches the boiling point. Then the color is developed by immersing the fabric in a bath containing sodium nitrite and sulphuric acid, or in one containing sulphuric acid and potassium bichromate.

In this manner there are obtained well-developed and uniform colors which possess the fastness of regular indigo.

Indigo sol can also be used in vigoureux printing.

Indigo sol is the first member of a new series of vat dyestuffs. Of course, it is not possible to convert all the vat dyestuffs into similar form, but the possibility remains that a large number of the indigoid colors and, furthermore, members of the quinonarylid and anthraquinone vat dyes can be converted into the "sol form." Earnest work is now being done to see if such changes cannot be performed.

These new forms of the vat dyestuffs are denoted by the symbol O, which indicates that the dyestuff in question is an esterified vat dye. Indigo Sol O and the other vat dyes are manufactured by various dyehouses in Europe.

This abstract is from an address delivered by C. Schreiner before the Ninth Congress of the International Society of Color Chemists in Vienna.

Dyeing Machines for "Tops"

The dye vat is divided into two compartments by a longitudinal partition. In one compartment is a trough with a curved bottom and a curved cover. The bottom and the cover are perforated over a portion of their width. Balls of "tops" are placed end to end in the trough, and dyeing or other liquor is forced into both compartments, the compartment not containing the trough being used for heating the liquor. The dye liquor is normally forced upward through the perforations in the bottom of the trough and, after passing through the balls, escapes through the perforations in the cover, but the direction may be reversed if desired to insure even dyeing. The apparatus is patented in British Patent No. 216,556.

Producing Colors for Printing Designs on Fabrics

Dyewood extracts, such as logwood, Brazil wood or fustic, or sulphur dyestuffs, or mixtures of dyewood extracts with sulphur dyestuffs, are boiled with acetic acid and, after cooling, the products are mixed to a paste with dry starch, dried and mixed with the usual printer's ink or lithographic inks, which have been heated on a water bath with alum, with constant stirring. Potassium carbonate or zinc salts may be added as mordants to the inks. The colors separate readily from the printing plates, adhere strongly to the fabric and are fast to light and washing. (German Patent No. 389,165.)

New Effects on Animal Fibers

Animal fibers, after treatment with chlorine or other oxidizing agents, are impregnated with paraffine wax stearine, ceresine, beeswax or similar substances in the absence of alkalies. The fibrous material may be dyed before or after impregnation. (British Patent No. 216,940.)

Treatment of Mercerization Waste Liquors

An electro-osmotic process is proposed for the treatment of the waste liquors that are recovered from the process of making mercerized cotton, which liquors also contain sizing materials. The purpose of the process is to purify these liquors. Electro-osmosis is employed to remove the colloidal impurities that are present in these waste liquors. It was found that a waste liquor 4 to 5 deg. Be. in concentration and containing from 3 to 3½ per cent of carbon (organic impurities), when treated in this manner, contained practically no organic matter after electro-osmosis. Furthermore, this treatment results also in an increase in the concentration of the caustic in the waste liquor. Of course, this process is practical only in those cases where it is possible to manufacture or buy cheap electricity, as the consumption of current is considerable, although at the same time the concentration of the liquor is materially increased. (Abstracted from an article delivered by Dr. G. Ullmann at the Ninth Congress of the International Society of Color Chemists at Vienna.)

Discharge with Tannin

Important experiments have been made on the use of tannin in the discharge method of printing fabrics. The experiments showed in the first place that the temperature has but little influence on the tannin-treated fabrics during the course of the drying process. High temperatures have the effect of darkening the shades obtained. Furthermore, the customary neutralization of the baths of tartar emetic also has no effect on the colors produced by this method.

The addition of reducing agents to the discharge liquor, such substances as rongalite, potassium sulphite and the like, is very important so far as the quality of the white produced is concerned. The cloth which has been treated with the discharge liquor must be dried as quickly as possible by steaming, if the liquor shows any tendency to run on the fabric, while the action of the discharge mixture is not affected by long contact with the goods.

Because of the possibility of the liquor running on the fabrics, it is also advisable to make the duration of the steaming operation as short as possible. Thorough souring and washing before dyeing is of particular importance in securing a fine white effect. In color discharge printing with the aid of vat dyestuffs it is important not to add too much caustic soda to the discharge liquor. Approximately 200 grams of caustic soda to the liter is generally sufficient for all purposes.

The printed fabrics should be left to hang for about twenty-four hours after steaming, so that the vat dyestuff is given a chance to oxidize. Then the fabric is treated with a dilute acid solution, soaped and washed. In coloring the fabrics with basic dyestuffs it must be remembered that the vat dyestuffs possess a certain affinity for the basic colors, with the result that a certain degree of overdyeing is apt to take place. (Abstracted from an address delivered by Prof. L. Kollmann at the Ninth Congress of the International Society of Color Chemists in Vienna.)

Purifying Wool-Washing Liquors

Wool-washing waters are treated with hydrochloric acid and an excess of lime, with the purpose of purifying them and rendering it possible to recover the products that they contain. The effect of this treatment is that the soluble soaps present in the waters are converted into the insoluble calcium soaps. The separation of these soaps is incomplete when calcium chloride as such is added to the waste liquors. The solids are then pressed in a filter press with or without heating by means of steam. The residue, which contains neutral wool fat, calcium soaps, lime and other impurities, is dried and then extracted with acetone. Fatty acids are recovered from the residue by distillation at a temperature of 180 to 280 deg. Cent. with superheated steam, and the non-volatile residue may

be employed as a fertilizer. Acetone is removed from the extract by evaporation, and the residual neutral wool fat is then separated from soaps in a centrifugal extractor by extraction with alcohol and afterwards refined and decolorized by the usual methods.

This process is patented in British Patent No. 219,985.

NEWPORT FEATURES INDIVIDUAL COLORS

The latest inserts for the Newport binder are two sheets showing swatch bows, dyed on one sheet with Newport Direct Fast Brown BT and on the other with Newport Diazo Fast Blue O. The method of application, notable features and fastness properties of each color are given, so that a complete set of the inserts dealing with individual Newport colors will represent a handy file to which the dyer may turn for answers to the dyeing problems he encounters in his work. For instance, the application and properties for Newport Fast Brown BT are given as follows:

"The dye bath is made up to a volume of twenty times the weight of the material. From 5 to 30 pounds of common salt is used, depending upon the quantity of dyestuff. The dyeing is started at a temperature of 140 to 160 deg. Fahr., and gradually brought to a boil and boiled for forty-five minutes. The yarn is then removed and finished. The quantities given are for 100 pounds of material. The dyeings shown were made on unbleached cotton yarn. This color is said to be of particular interest as a base for making brown or tan shades. Its fastness to washing is improved with a chrome after-treatment, and, likewise, it is very much faster to light when after-treated with bluestone. Unions of cotton and wool are dyed to about the same shade, and on silk and cotton combinations the silk is dyed somewhat yellower and brighter. Pure silk and artificial silks, except Lustron and Celanese, are dyed well. It will discharge a clear white."

The Travellers Insurance Company has issued an interesting, well-illustrated 25-page booklet which gives complete information about group insurance for plant employees. The booklet contains some very interesting facts relative to employment problems for employers, and explains fully the beneficial functions of group insurance.

A late news report states that the re-establishment of the German monetary system upon a gold basis is resulting in a transition from the low Cartel dye prices current during the early months of the year to quotations more comparable to American dye prices. This price balancing affects particularly the quantity colors—Indigo and Sulphur Black. Indigo in the German market was quoted for a period at 2 cents per pound. Lately, however, this product has been sold in German markets by the Badische Company at 20 to 22 cents.

DYESTUFF TABLES

(*Continued from page* 659)

DYED BY OTHER METHODS: Chrome bottom about the same shade as the acid dyeing. Top-chromed, darker and somewhat duller.

ON UNIONS: Cotton-effect threads are stained slightly. Silk-effect threads are stained nearly as heavy as the wool. Viscose silk threads are very slightly stained. Lustron-silk-effect threads are stained reddish. Celanese-silk-effect threads are stained yellowish.

ON OTHER MATERIALS: Silk: Dyed in a bath of boiled-off liquor broken with sulphuric acid.

PRINTING: Prints good, but not fast to washing.

DISCHARGING: Discharges good with sulphoxalates.

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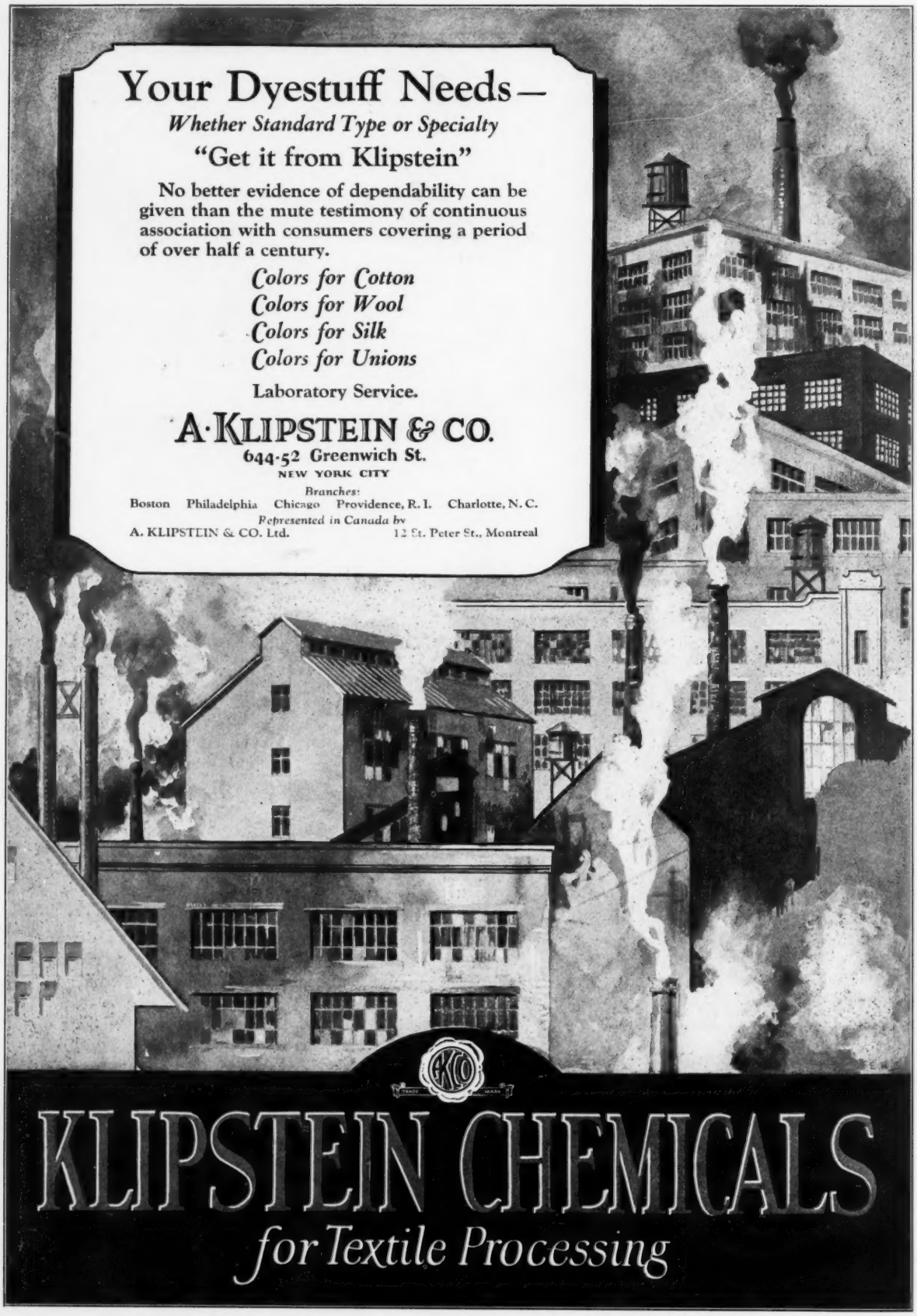
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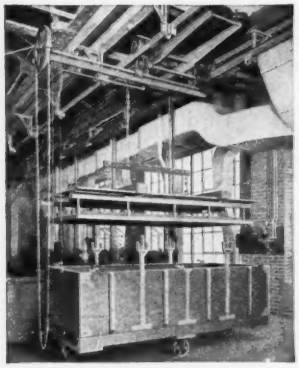

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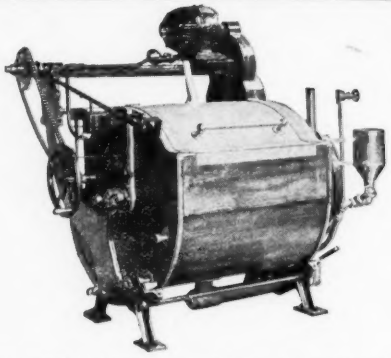

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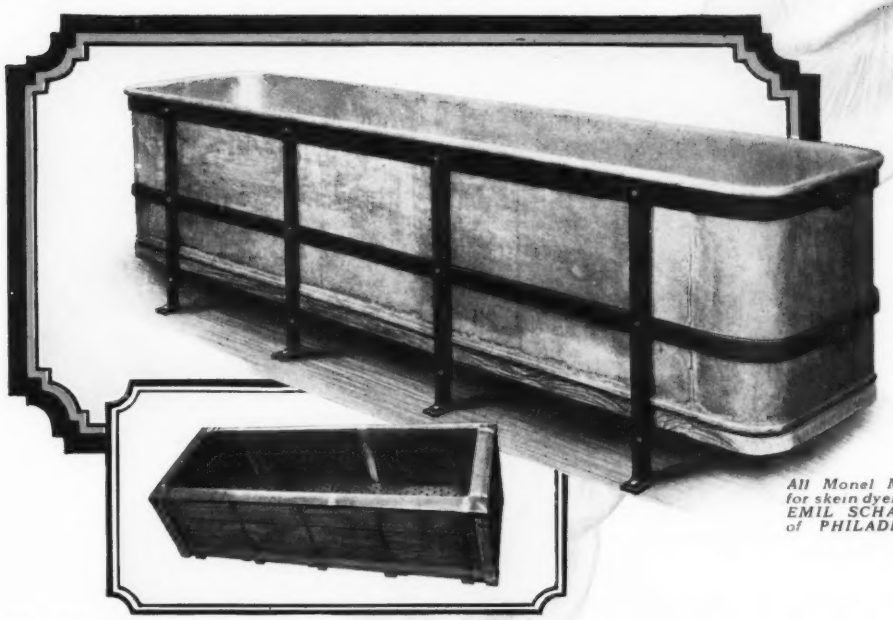

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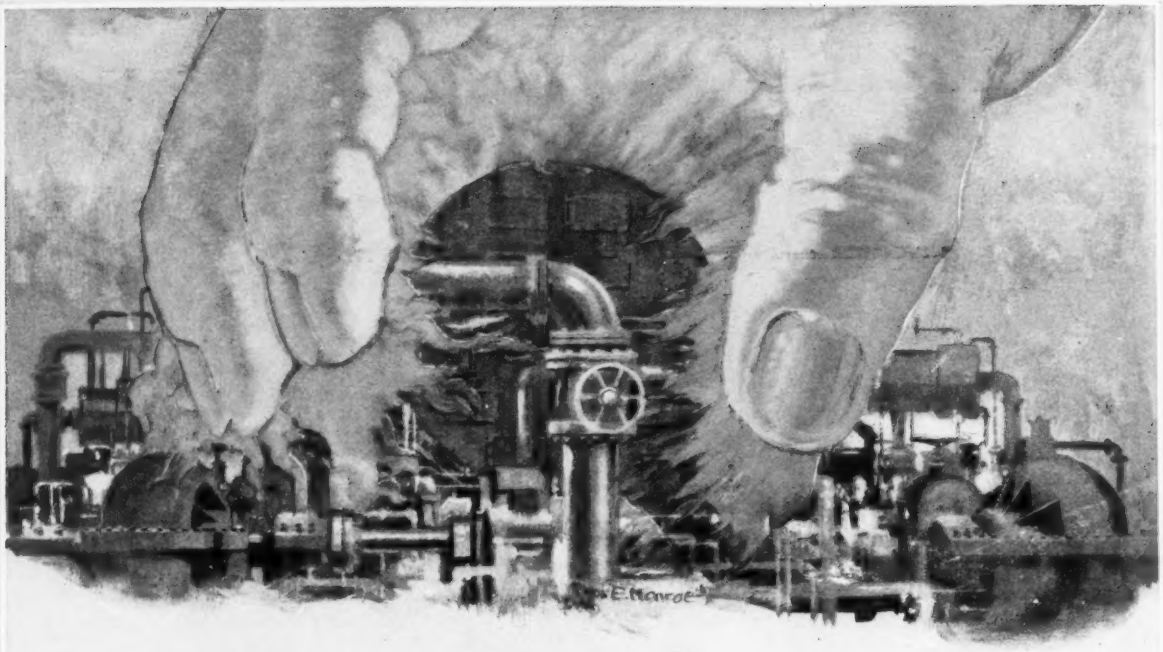

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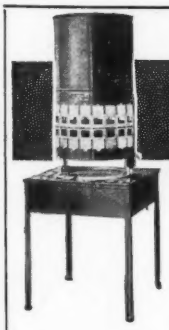

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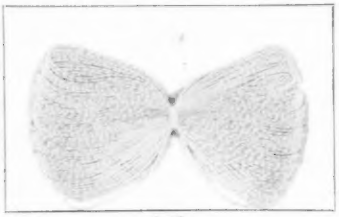
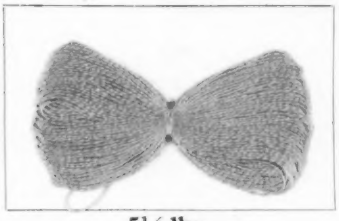
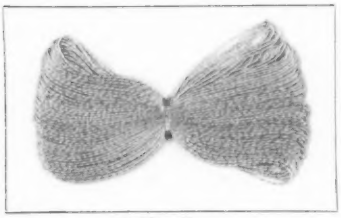


1 lb.

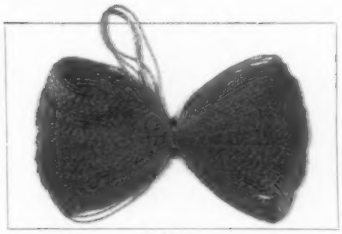


5½ lbs.

PONSOL GOLDEN ORANGE RRT DOUBLE POWDER



1 lb. 5 oz.



8 lbs.

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New York Boston Philadelphia Chicago

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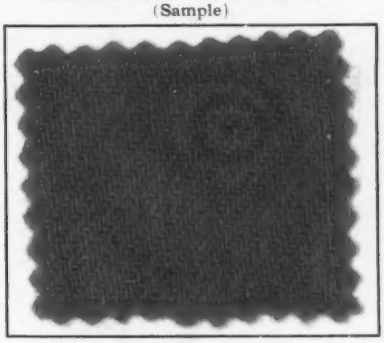
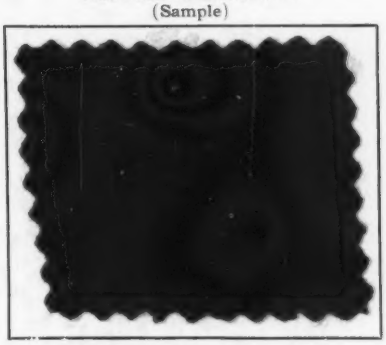
(Sample)



Per 100 lbs. of stock
1 lb. 8 oz. Calco Acid Orange Y
15 lbs. Glauber Salt Crystals
3 lbs. Sulphuric Acid
Boil 1 hour and wash.

HAVANA BROWN
(Sample)



Per 100 lbs. of stock
14½ oz. Calco Acid Orange Y
8 oz. Calco Alizarine Blue SAPX
1½ oz. Calco Acid Phloxine GX
3 lbs. Sulphuric Acid
15 lbs. Glauber Salt Crystals
Boil 1 hour and wash.

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(Sample)

Per 100 lbs. of stock
5 lbs. 15½ oz. Calco Acid Black BX
11 oz. Calco Acid Orange Y
5½ oz. Calco Wool Red B
2 lbs. Sulphuric Acid
15 lbs. Glauber Salt Crystals
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Hydroxy Finishing Oil.

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Hydroxy Para Soap—For dyeing Para Reds.

Hydroxy Silk Soap—For degumming skein silk.

Hydroxy Textile Oil—For wetting out, dyeing, softening and finishing. The highest grade made.

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Hydroxy Benzine Soap.

Turkey Red Oil—50% and 75%.

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Cresylic Acid—Dark
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Lactic Acid
Muriatic Acid, Tech. and C. P. (Hydrochloric Acid)
Nitric Acid—All strengths
Oxalic Acid
Phosphoric Acid—Tech. and U. S. P.
Pickling Acid, for cleaning castings
Pyroligneous Acid
Salicylic Acid—Powdered Preservative for size
Salicylic Acid—Sublimed
Salicylic Acid—U. S. P.
Salicylic Acid—from natural oil
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Tannic Acid—Powdered for dyeing
Tartaric Acid

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Alumina
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- Sulphate of Alumina—Ground or lump—Tech. and iron free
- Chloride of Alumina

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- Chloride of Ammonia (Sal Ammoniac)
- Oxalate of Ammonia

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Borax—Lump and Powdered
Calcium Chloride
Carbon Bisulphide
Carbon Tetrachloride
Chrome Acetate
Chlorates
- Sodium Chlorate
- Potassium Chlorate

Copper Sulphate (Blue Stone)
Dextrine
Epsom Salt—U. S. P. and Tech. (Magnesium Sulphate)
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Gelatine—Sheets and Ground
Glauber's Salt—Crystal and anhydrous
Glucose
Glue—Sheets, Broken and Granular
Glycerine—Tech. and C. P.
Grape Sugar
Gums
- Arabic
- Tragacanth
- Flexible Gum (for silk size)

Iron
- Nitrate of Iron—By Copperas—Red Iron
- Nitrate of Iron—True
- Pyrolignite of Iron—Black Iron
- Sulphate of Iron—Copperas

Lead Acetate (Sugar of Lead)
- White—Crystals and Powder
- Brown—Broken

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- Neatsfoot Oil—Low acid test for Throwsters
- Olive Oil
- Castor Oil, No. 3
- Castor Oil, U. S. P.
- Oil of Vitriol (Full 66° Be.)
- Lard Oil
- Lard Oil—Winter pressed
- Oil of Wintergreen—Synthetic
- Turkey Red Oil

Oxalate of Ammonia
Peroxide of Hydrogen
Potash
- Carbonate of Potash
- Caustic Potash
- Bichromate of Potash
- Chlorate of Potash

Soaps
- Palm Oil Soap
- Red Oil Soap
- Olive Oil Soap

Sal Ammoniac—Ground
Soda
- Acetate of Soda—Tech.
- Soda Ash, 58%
- Bisulphite of Soda—40°
- Bisulphite of Soda—Anhydrous (Powdered)
- Caustic Soda—Grounds, Flakes Fused and Solution
- Chlorate of Soda
- Bicarbonate of Soda
- Bichromate of Soda
- Hydrosulphite of Soda—Anhydrous (For discharging and dyeing)
- Hypochlorite of Soda (Javelle Water)
- Hyposulphite of Soda
- Nitrate of Soda
- Phosphate of Soda
- Tri Sodium Phosphate
- Sal Soda—Crystals (Carbonate of Soda)
- Silicate of Soda—42° Be.
- Silicate of Soda—Heavy Syrup
- Sulphate of Soda (Anhydrous Glauber's Salt, Dry Powder)
- Sulphide of Soda—Crystals
- Sulphide of Soda—Concentrated, 60-64%
- Sulphite of Soda

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Starch
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Tin
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- Permanganate of Potash, Tech. and U. S. P.
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Zinc
- Zinc Chloride—Fused
- Zinc Chloride—Solution 20° and 42° Be.
- Zinc Dust
- Zinc Sulphate—Technical

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Your selling agent
wants durable goods.
They mean re-orders
and building up Good-Will.
Tests will show that
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Mercerizing Cotton Goods in the Piece

Principle of Mercerizing—Effects on Different Cottons—Various Mercerizing Methods—Operation of a Mercerizing Range—Penetration of the Caustic—Souring—Recovery of Caustic

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THE mercerizing of cotton goods in the piece has become a very important art, and most every bleachery and finishing plant has more or less of it to do. Although the process appears rather simple (that is, passing the goods through a caustic solution in a padder and then stretching them on a tenter frame, and finally washing to remove the excess caustic), still each plant carries out this operation with slightly varying details. In some plants the goods are mercerized before boiling, while in others after boiling, and in some special cases after bleaching. Some mercerize the goods dry, while others wet them out. The machinery also varies in details.

Whatever method may be used, the principle involved is the same: the changing of the cotton fiber from its original flat ribbon shape to a round rod-like shape which reflects more light and has what is known as luster. The kind of cotton, as well as the strength and temperature of the caustic, the duration of exposure of the fiber to the caustic and the tension under which the fiber is held, has a great deal to do with the luster produced.

Effects on Different Cottons

When a pure cotton fiber—one from which all the pectic matter has been removed—is exposed to the action of pure caustic soda of a 20 to 25 per cent concentration at room temperature (60 deg. Fahr.) for about a minute, the twisted ribbon-like fiber is seen first to untwist, then to swell, become transparent, and then contract about one-quarter its length and assume a round, rod-like elastic appearance. If the fiber is then stretched under tension to nearly its original length and the caustic solution is washed from it while still under tension it will remain that length after the tension has been released, and will have taken on a much higher luster than the original fiber. Not only has it undergone this physical change, but it has also undergone a chemical change. The exact change has not been definitely determined, but the reaction is supposed to take place in two steps: First, the sodium hydroxide (NaOH) combines directly with the cellulose, forming an alkali cellulose, and then the sodium (Na) is replaced by hydrogen (H) during the washing, thereby forming a hydrated cellulose.

In mercerizing cloth which is made up of yarn spun from many cotton fibers the same action takes place. However, other factors enter into account during cloth mercerization: First, the length of the staple cotton used, and, second, the twist of the yarn. As a general rule, the longer the staple the less twist is required to make a yarn of suitable strength. The individual fibers in this case lie more parallel than in a yarn of short staple, which has to be tightly twisted to give it strength.

Of course, combed cotton will give the best results in both cases, as combing straightens the fibers and lays them more or less parallel before spinning. It is these many lustrous parallel rod-like fibers, which reflect the light in many directions, that give a high luster to the cloth. With the cloth made up of tightly spun short fiber yarns the surface is so broken up by the interlacing of the fibers that it does not reflect nearly as much light and is therefore not so lustrous. Also, in the case of the latter the individual fibers are not equally stretched after the action of the mercerizing liquor, and therefore do not acquire as high a luster.

The grade of cotton used also has a great bearing on the results. Some cotton originally is more lustrous than others, and consequently when mercerized this same proportion holds. Sea Island cotton is the most lustrous, and is therefore the best for mercerizing;

but well-combed American cotton gives excellent results.

Various Mercerizing Methods

The above refers mostly to what happens during mercerizing; but there is still another very important part in the process to be considered from a practical point of view, and that is the cost. This is the point that causes the various bleacheries to differ in their methods. The following are some of the methods in use.

The cheapest method is to take the goods direct from the bale and sew them end to end and run them through the mercerizing range. After leaving the range they still retain some of the caustic, which is a help in the next process of kier boiling. The results thus obtained are only fair, because the caustic does not have a chance to penetrate into the fiber as it should, owing to the natural waxy coating around the fibers and the size put in before weaving. However, if this is carefully carried out the goods will have a little more luster than the original and will be a little more crispy to the feel and have greater affinity for dyes. It is suitable for certain cheaper classes of fabrics.

The next method is to wet the gray goods out on a water mangle with plain water or perhaps with a little soluble oil. Then, when the goods go through the caustic saturator they will be better penetrated. Consequently, the better the penetration the better the mercerizing, other things being equal. However, in this case a stronger stock solution of caustic must be used, because the wet cloth dilutes it considerably. Generally a stock caustic of 60 to 70 deg. Tw. is used. The luster obtained in this method is only fair, but is greatly improved by Schreiner calendering.

A third method is to boil the goods in a kier, then wash and mangle through a good water mangle and run through the mercerizing range. The principle is the same as the second method, but the results are better because the cloth has been freed from the waxy matter and sizing by the kier boil.

A fourth method is to take the goods from the kier, as in method three, and wash, mangle and dry before running them through the mercerizing range. This method is the most costly but, in the writer's opinion, gives the best general results, which more than repay for the slight extra drying cost. In this case the caustic can be reduced to about 50 deg. Tw., which saves considerable, especially when the wash water is reclaimed by evaporation. This will be taken up in a later paragraph. Also, more uniform mercerization may be expected throughout the lot than in cases where goods are wet out and put into box trucks to be delivered to the mercerizing range. In this case the water tends to seep to the bottom of the box and the top thereby gets dry, especially when the boxes stand for any length of time. The drier part will take on a little better mercerization, which will show up when the goods are dyed, because it will dye a little heavier in shade. In mercerizing wet goods the caustic must be kept at a lower temperature than when dry mercerizing, to take care of the heat of reaction between the water from the wet goods and the caustic.

Still another method is to run the goods through a padder containing the strong caustic and put them on rolls. The rolls are allowed to stand for a time, and then run through the mercerizing range. This method is resorted to only where the goods are heavy or hard to penetrate in the regular way.

One method sometimes used is to mercerize after bleaching, but this is carried on very seldom because there is a chance that oil stains or other trouble may develop which will require reboiling and rebleaching of the goods, thus adding expense to the process. There are several other methods of mercerizing, but they are used only in special cases.

The Operation of a Mercerizing Range

The mercerizing ranges in use to-day may vary slightly in detail, but generally consist of a three-bowl padder, a tenter frame either 60 or 90 feet long, and a series of wash boxes. The accompanying figure illustrates the line-up of these different parts. This range has been found to give excellent results, and most any weight goods, either wet out or dry, may be mercerized in it.

The goods enter, as shown, either through the floor above or over a high crossbar, then straight down through cloth guides (A), which may be either the Foxwell or Bolton type, the former working much better in the case of wet goods. After passing through the guides the goods pass under and over a series of iron rolls (B), the lower set being submerged in the strong caustic liquor. Here the goods become impreg-

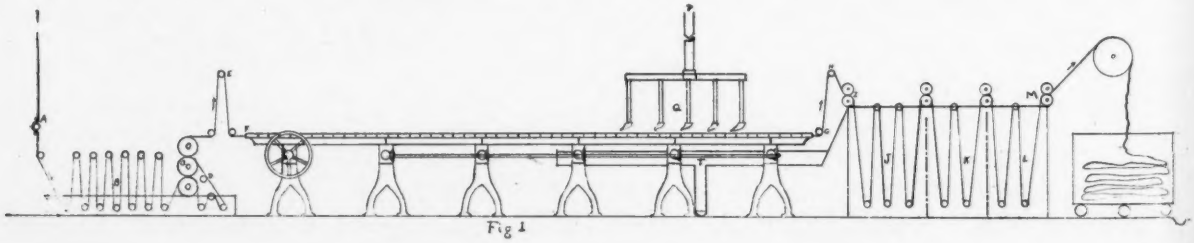

Fig 1

nated with the caustic, and then pass through the lower nip of the mangle rolls (C). These rolls consist of two steel rolls with a rubber roll between. After leaving the lower nip the cloth again passes into the caustic to insure complete saturation. On leaving the solution it passes over a revolving scroll (D), which removes any double edges or wrinkles that may be in the cloth. From here it passes through the upper nip, where the excess liquor is thoroughly squeezed out.

After leaving the nip the cloth passes over a tension roll (E), as shown. This roll moves up or down, according to the tension of the cloth, and may be weighted according to the strength of the cloth passing through. This insures an even tension on the warp threads at all times before the cloth enters the tenter frame F, and prevents much damage caused by excess tension due to the shrinking of the cloth. The mangle and the frame are controlled by two different motors, and either one may be stopped for a fraction of a minute so that the tension may be regulated.

The goods enter the frame proper at F, and on a 60-foot frame the first section, which is about 10 feet, may be adjusted to receive the cloth and gradually pull it out to the proper width and keep it so on the remainder of the frame. On a 90-foot frame generally two sections, or 20 feet, are used for this purpose. This gives a more gradual pull and reduces chances of clip damage to the selvages.

The frame consists of two endless chains running parallel and supported rigidly to keep them free and level. Automatic tenter clips are attached to this chain, and as the cloth enters at F they grasp the selvages and hold the cloth taut. The more tension that is applied the tighter they hold. Therefore, if the cloth will stand the strain it can be pulled out to its original width. However, a slight allowance is generally made on all mercerized goods. It is due to this tension that the cloth becomes lustrous.

At the last section of the frame the cloth is washed by spraying warm water upon it at Q. This washes out the excess caustic as well as completing the second step in the chemical theory previously mentioned. Warm water at 80 to 90 deg. Cent. is used in the washing because it is more efficient in removing the caustic than cold water. After the water passes through the cloth and absorbs the caustic it is caught in a large pan (T), as shown, and returned to the evaporators or used as a kier solution, as the case may be.

The spray pipes are connected to a swivel joint so that they may be turned to fit any width of cloth being run without wetting the chain too much, as it is necessary to keep the chain as dry as possible. For this purpose there is placed several compressed-air nozzles on the outer sides of the chains, which blow off the excess water from the clips. If wet clips are allowed to strike the body or selvage of the cloth on entering the frame they form slight variations of mercerization, which show up when the cloth is dyed.

At the extreme delivery end of the frame the cloth is automatically released from the clips and passes over a tension bar (H) similar to E. From here it passes through a set of squeeze rolls into the wash boxes. The wash boxes are so arranged that fresh warm water is sprayed on the cloth at M and gradually flows back into box L and finally into box J. This insures almost complete removal of the remaining caustic. The overflow at J is piped to the heater that supplies the warm water for the spray pipes and is reused as a spray. This increases the alkali content of the wash water and makes it economical to evaporate for reuse in the mercerizing bath.

After going through the wash boxes the cloth is again squeezed as dry as possible, and is either packed into box trucks or bins and is ready for the next process.

Penetration of the Caustic

As explained in a previous paragraph, the caustic must thoroughly penetrate the cloth to insure the best mercerizing results. Various weights and constructions of cloth will require different lengths of time in the bath to be properly penetrated, and it is for this reason that the lay-out of B (Fig. 1) has its advantage. When the goods are thoroughly penetrated they become transparent. The cloth should be watched as it goes under and over the rolls, to find at just what point the goods become transparent, and then all the extra rolls should be eliminated. After one becomes experienced one can readily tell by looking at the cloth just about how long it will take in the caustic. The wash water at the end of the frame can be regulated in a similar manner. This type of saturator has its advantages over the saturator containing only a few rolls, the top rolls of which are generally placed under or just above the liquor, because the speed of the machine does not have to be sacrificed to insure good penetration.

Mercerizing Damages

The mercerizing department, if not carefully supervised, will cause considerable damage and many lots of seconds. The most frequent damages are torn selvages and let-outs. This may be caused by poor working clips or clips that become nicked; secondly, by trying to stretch the cloth beyond its elastic limit; thirdly, by not feeding the cloth into the frame evenly or by allowing the edges to double over in cause of wide selvages; fourthly, by having too great a tension at E (Fig. 1)), and, fifthly, by allowing the cloth to stay in the caustic too long.

Another mercerizing damage that does not appear until the cloth goes through the succeeding processes is cloth mercerized less than the required finishing

width. This causes the selvages to tear when the finisher tries to pull the finished goods out of the required width. When the clips are nicked or do not seat properly, they may cause small cuts in the selvages which are not noticed on the mercerizer; but when the goods are pulled through the bleach-house washers, the strain breaks the cloth at these small cuts.

Uneven mercerizing is caused by either poor kier boiling, uneven washing at the sprays (Q, Fig. 1) or uneven wetting of the goods (in cases where the goods are mercerized wet). These do not show up in the white, but in dyed goods they show up as streaks. By not thoroughly washing out the caustic and allowing parts of the goods to become dry while in this state, then not souring properly, these appear as resists in dyed goods, especially in pad dyeing.

Seams are sometimes broken when the proper quality of sewing thread is not used. Oil stains are quite frequent if the chains are not oiled carefully; care must be taken in the selection of the oil used. A good saponifiable or emulsifiable oil must be used instead of the ordinary mineral-base oil. Spots caused by this latter are very difficult to remove. There are certain automatic oiling attachments on the market which are very efficient in oiling the chains.

Souring

Silk and cotton union goods may be mercerized in the regular way, but must be soured immediately after coming off the mercerizing range; otherwise the silk will be seriously tendered. The souring and final washing is generally done in an open-width compartment washing machine. This machine consists of an acid compartment and several clean water-washing compartments, and is run in tandem with the mercerizing range.

Aside from producing lustrous cloth, mercerizing is resorted to for still another purpose: the shrinking of cotton goods. This resembles fulling in a woolen mill to some extent. Goods of, say, 40 inches wide may be run through the range and the frame set 34 or 36 inches. This thickens the goods and changes the feel; they also have better affinity for dyestuffs.

Recovery of Caustic

In plants where mercerizing is done on a large scale the caustic is generally recovered from the wash water. This is done by using the wash water in the sprays over and over again until it becomes of sufficient strength to pay for its recovery (4 or 5 per cent). It is then collected and pumped to the evaporators and evaporated to sufficient strength for use in the mercerizing bath. The caustic bath on the range must be emptied and cleaned from time to time of the sludge which settles at the bottom of the tank.

In plants where the goods are mercerized in the gray before boiling they get considerably more lint and sludge deposited in the mercerizing liquor than in plants where the goods are boiled and washed before mercerizing. The kier boiling and washing removes the lint, waxes, sizing materials and much of the natural coloring matter. The sludge, therefore, contains lint, insoluble soaps, starches and other sizing materials, and more or less of the natural coloring matter. Where the caustic is recovered from the wash water these impurities have to be removed by filtration or precipitation, or both, before the caustic is used again.

Pure caustic soda is the best and cheapest mercerizing agent. Neutral salts and carbonates tend to reduce the mercerizing action of the caustic. Sulphuric acid and zinc chloride will act similar to caustic, but are more costly and require extra careful handling, and the final results are no great improvement over caustic.

There are several manufactures of tenter frames which may be used in the stretching apparatus of the mercerizing range. Some make light frames which are serviceable only for lighter weight cloth. One or two make a heavy frame which will handle any kind of cloth. This frame, of course, costs more than the lighter ones, but in the long run pays for itself, having fewer breakdowns and a longer life. Some frames are equipped with ball or roller bearings, which is a great improvement.

The type of range used, as well as the kind of cloth to be mercerized, governs the speed at which the machine may be operated. With an equipment similar to Fig. 1, containing a long caustic bath, heavy mangle, heavy roller-bearing tenter frame and sufficient washing capacity, a speed of 100 yards per minute may be used and very excellent results obtained on even fairly heavy cloth.

AMERICAN DISTRIBUTORS FOR "SRA" COLORS

American-British Chemical Supplies, Inc., 15 East Twenty-sixth Street, New York City, have been designated as authorized distributors in the United States for the "SRA" and "CR" colors manufactured under formulae controlled by the American Cellulose & Chemical Company. These colors are particularly designated for the dyeing of Celanese—the "SRA" colors having the property of coloring Celanese while leaving cotton and other forms of artificial silk unstained, and the "CR" colors dyeing both cotton and artificial silk but leaving Celanese white

The availability of these colors in the American market will obviate the difficulties which dyers attempting to process Celanese have heretofore encountered.

Mercerizing: Modern Research and Its Results—I

The Mercerization of Single Cotton Hairs—Relation Between Caustic Strength and Contraction of Cotton —Maximum Swelling of Special Significance but Limited by Cuticle—Bearing of Other Variables—Theoretical Effects Not Fully Realized in Practical Mercerizing

By CHARLES F. GOLDTHWAIT

[EDITOR'S NOTE.—*This is the third article in the series on "Mercerizing" by Charles F. Goldthwait which began in the September 22 issue of the* AMERICAN DYESTUFF REPORTER. *Most of the graphs in this installment are from the Journal of the Textile Institute.*]

WHILE there has been much research on the mercerizing of cotton with a view to explaining its action and learning more about its possibilities, most of the experiments up to 1922 were made on yarn or piece goods where there are a host of variables and factors which cannot be separated or controlled. The change in length of yarn on mercerizing is a result of changes in length, diameter and shape of cotton fibers, and of the slipping of fibers in the yarn, so that results on yarn give no idea of any single property of cotton when subjected to mercerizing conditions. Recent English workers, on the contrary, have begun with single cotton fibers which for botanical reasons they prefer to call cotton hairs.

This action is in accord with all modern textile research and is the logical procedure, for even though the cotton fiber is only an inch or two long at best and but a twelve-hundredth in diameter, it is the unit of which the yarn and pieces are made and its arrangement and manipulation in manufacture determine the properties of the product. It is possible, too, that single fiber studies will eliminate some of the more complex work on yarns and fabrics.

We cannot carry conclusions bodily from single fibers to yarn and cloth, but the tendencies can be seen and are much the same. The single fibers are free to do as they please while in the more complicated structures most of them are more or less restrained by twist and interweaving. However, in many respects their behavior is remarkably similar.

Researches on single fibers begin with the effects of caustic soda of different strengths. The general effect is a swelling of the fiber accompanied by a shrinkage in length, but the changes are found to be exceedingly complex.

CAUSTIC STRENGTH AND FIBER CONTRACTION IN LENGTH

Experiments were conducted by immersing fresh separate fibers in different baths of the various strengths, the fiber being held out straight with the minimum tension, and the changes in length accurately measured [5]. As a result, Fig. 1 is probably the most complete curve ever worked out to show the exact relations between strength of caustic and contraction of cotton, uncomplicated by any of the restraining factors due to the construction of yarn or cloth, and not under tension.

The solid line is the caustic curve and the dotted line is the corresponding curve obtained on washing the fibers after three minutes' immersion in the caustic bath. The notable points on the curves are first at 10 deg Tw., where the fibers have become longer instead of shorter, apparently due to softening and the straightening out of convolutions since water alone has a similar effect. Especially remarkable is the sudden change between 20 and 30 deg., the greatest contraction of nearly 9 per cent taking place at 30 deg. Tw., or about 13.5 per cent. Structural changes in the fiber, not yet announced, have been noticed here. It is noteworthy that this point corresponds closely with the point of maximum swelling, noted later, which has long been regarded as especially

Changes in length of Cotton Fibres (scoured) placed in NaOH solutions. Tension 50 mgms. (One fibre in one solution.)

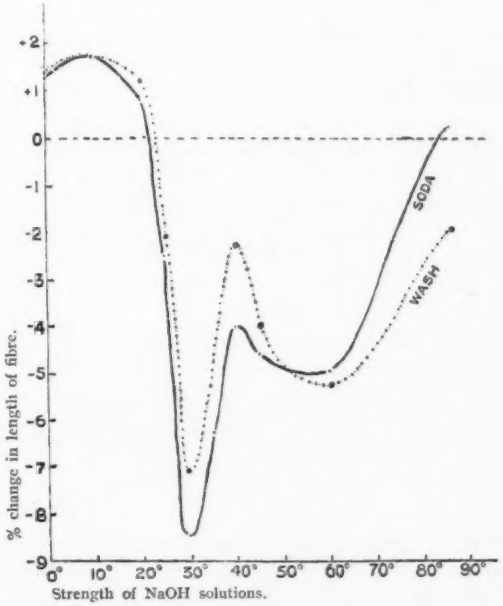

FIG. 1.—*Change of Length of Single Fibers at Different Caustic Strengths*

significant in practical mercerizing. The succeeding contraction with solutions up to 40 deg. and increase again to 60 deg. are interesting, but their significance is not at all clear.

Incomplete work showed that repeating the tests with

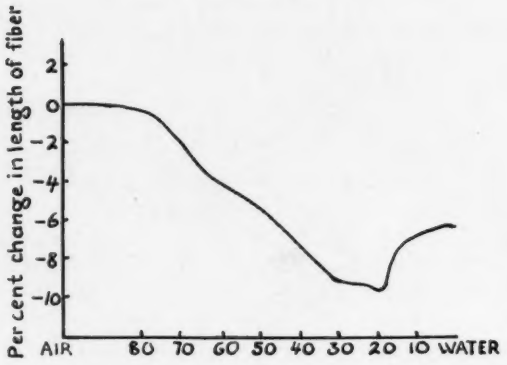

FIG. 2.—*Illustrating the Effect of Slow Washing*

fibers under tension tends to smooth out the maxima and minima. The effect of temperature changes has not yet been determined.

The effects observed might be ascribed to changes in the solutions, structural peculiarities of cotton hairs or to a series of chemical reactions. Extended study has failed to reveal any connection with changes in the known physical properties of caustic solutions. A great deal more knowledge will be required to answer the last two questions, but there are probably no true chemical reactions.

EFFECTS DURING WASHING

Washing has peculiar and important effects but these cannot yet be translated into terms of practice. Some strong solutions have less mercerizing action than weaker caustic, and if washing is not too rapid, the consequent dilution of the caustic in the fibers may lead to a greater mercerizing effect. The curve in Fig. 2 shows the result of an experiment made to duplicate slow washing. Fibers were first immersed in a solution of 70 deg. Tw., then successively weaker solutions. There is a continual shrinkage down to 20 deg. Tw. and finally a small return in length. At the same time the diameter, i. e., the swelling of the fibers, was found to increase during this sort of treatment. Since the increase in diameter during slow washing reached 40 per cent, it is evident that important effects occur during this part of the process. It would not be strange if careful analysis would show in some instances in mill practice that stronger caustic solutions than necessary were being used, and that an unsuspected mercerizing effect was taking place in the washing, the desired result being obtained, but at the expense of excessive caustic consumption.

MEASURING ABSORPTION OF CAUSTIC

Another method of attack on the problem of the amount of caustic solution absorbed by cotton, on the amount of swelling and hence on the extent of mercerization, has been further developed by Coward and Spencer [6]. With a small centrifuge at a speed of seven to eight thousand revolutions per minute they have conclusively shown that the loose liquid in cotton could all be extracted within 5 or 10 per cent of the weight of the fiber itself. Since cotton held about 50 per cent of its weight of water and up to 200 per cent of its weight of caustic solutions after extracting, these are the amounts held within the fibers as distinguished from that held between them and the higher figures represent indirectly the swelling.

The results are more clearly shown by a curve than by detailed explanation, Fig. 3. The curve marked "total" is the amount of solution absorbed and represents roughly the swelling, which in this case means change in volume, not merely in diameter. There is a rapid swelling up to a 14 per cent solution, the minimum strength which gives well defined mercerizing in practice, and above that only a slow increase.

This corresponds closely with the point of maximum shrinkage in length, shown so clearly in Fig. 1, so again 14 per cent seems to represent a very significant value in mercerizing.

Since the curve is plotted from weights of solutions which were being varied in specific gravity through the tests, the swelling is more correctly represented by the calculated volume of the absorbed solution. Above 14.3 per cent strength, 100 grams of cotton absorbed 177 c.c. with an error of plus or minus 8. In Fig. 4 the curve

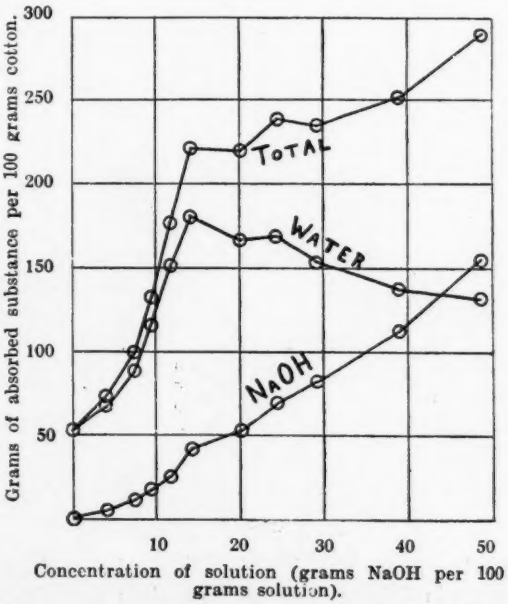

FIG. 3.—*Absorption of Caustic by Cotton Fiber*

marked "fiber" represents the same data calculated to volume, and this curve, which is close to facts, shows more clearly that there is no further increase in swelling in caustic solutions above 14 per cent caustic strength. The same is true for a fabric as shown in the same figure. The constancy of the maximum over so great a range suggests that the cuticle sets a definite limit to the swelling of the cellulose within.

Structure of Cotton Fiber

Since cuticle means more than external surface, a little description is in order. The cuticle proper in epidermal plant cells is the outer coating, but in cotton it is indistinguishable from the primary wall, which is the wall that develops first and forms the outside of the growing cotton hair. Later there is a thickening called the secondary wall. The ripe cotton hair is a tube consisting essentially of the two walls which are composed of two kinds of cellulose, or more likely of cellulose in two different colloidal states. Normally it is not only hollow but flattened. When swollen by caustic it becomes nearly round, and the central opening becomes filled, sometimes completely.

The old idea that cotton fibers lose the cuticle on mercerizing has been exploded, if we understand cuticle to be the outer layer of true cellulose and not merely the incrusting impurities. It has been shown by mercerizing cotton dyed with alizarin which is coated on the outside of the fibers. If the cuticle came off, the dye would come with it and there would be colored particles in the caustic bath as well as stripping of color.

Since the cuticle or primary wall is now recognized as differing in its properties from the secondary cellulose we can see that it might act differently in caustic solutions. An interesting conformation of the view that the cuticle sets a limit to swelling is clearly shown by a photograph [7] of small sections of cotton hairs swollen in caustic of 30 to 40 deg. Tw. The tendency of the interior to swell was so great that it has filled up the center and squeezed out at the ends when restrained by the cuticle, giving a dumbbell effect (Fig. 5).

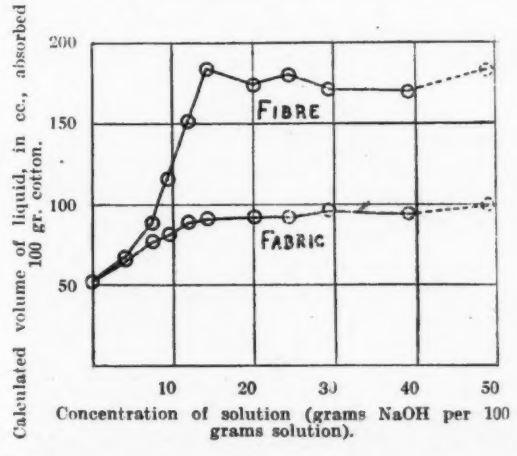

Fig. 4.—*Comparative Swelling of Loose Fibers and Fabric*

Fibers Become Two and One-Half Times Original Size

Coming back again to measurements of single cotton hairs when treated with caustic soda, there is still another

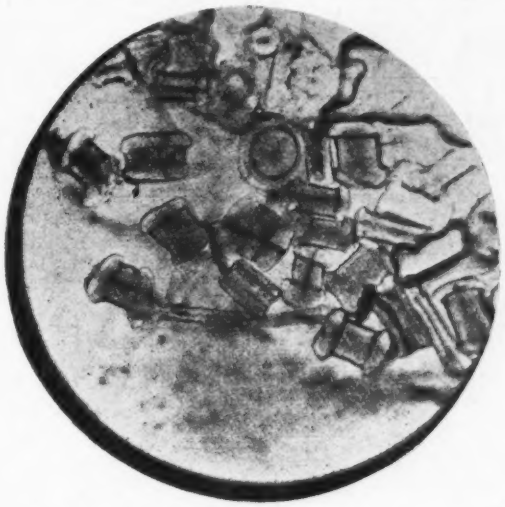

Fig. 5.—*Cotton Swollen by Caustic but Restrained by Cuticle*

investigation, this time by Collins and Williams [8] who measured the changes in both length and diameter of cotton hairs on immersion in caustic of different strengths. Their results are in almost startling agreement with others cited and are shown in Fig. 6. The sharp change takes place at 14.5 per cent caustic strength, exact agreement with the 14.3 per cent of Fig. 3, and there is little change beyond; also in agreement with the point of maximum shrinkage of Fig. 1. While the length shrinks 12 per cent, the diameter increases over 60 per cent., and the combination gives an increase in volume of almost 150 per cent or a total volume of two and a half times that of the original cotton.

The three main investigations are summarized in the table:

	W. B. & P.	C. & S.	C. & W.
	%	%	%
Point of maximum change.	13.45	14.3	14.5
Loss of length	8.5	....	12.
Increase in diameter.....	....	....	60
Increase in volume or total swelling	....	175	145

Corresponding figures are of the same order and considering the nature of the work are in very good agreement. That three different methods should lead to so nearly the same conclusions emphasizes again that there must be something specially significant in the neighbor-

hood of 14.5 per cent, which has been found to be just about the lower limit of mercerizing strength.

While it may be assumed that this point of maximum swelling should give the best mercerizing results, we

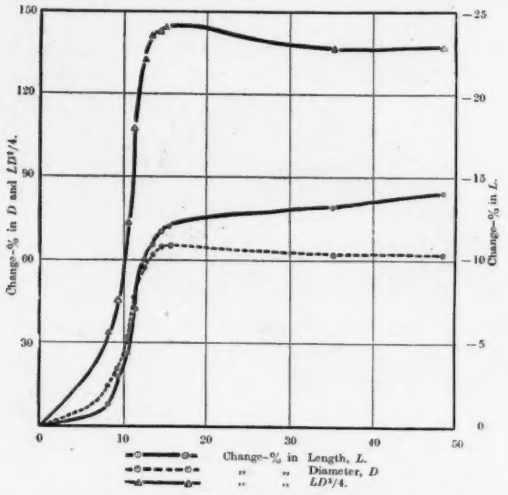

FIG. 6.—*Change in Volume and Dimensions of Single Fibers*

know from daily experience that yarn or cloth does not swell up to two or three times its bulk. Penetration, time, temperature and numerous other factors tend to make practical conditions vary from those that are theoretically correct. A little more caustic does not matter much if there is a recovery system, and most of us prefer to work on the safe side and be sure to have our baths strong enough. They must certainly be stronger when we are handling wet goods which keep diluting them. Practical mercerizing must still be governed by experience.

We can note, however, that the outside fibers which are less restrained than those within the goods must respond in some such way as indicated by the experiments, and it is these surface fibers that contribute most directly to luster.

OTHER VARIABLES IN MERCERIZING

Experiments on single fibers have not only brought out their peculiar behavior in swelling to a remarkable degree at a certain critical caustic strength, but have also thrown light on the effects of several other practical mercerizing conditions.

The usual statements that the mercerizing action is over in a few seconds is not true, even for single cotton hairs [5]. For various strengths of caustic up to 45 deg. Tw. the contraction in length was approximately three-fourths complete in one-half minute, but at 60 deg. it was only 10 per cent complete. In all cases it was nearly complete in two or three minutes, but was still taking place for that length of time. In actual mercerizing the time of immersion in caustic usually falls between one-half and four minutes. The true time during which the caustic acts is, however, longer in most cases than appears at first thought. In handling piece goods we can add the time required for a good share of the run down the tenter; in skein mercerizing there is a wringing period; and in handling warps the time is lengthened by the extension frames above the caustic compartments. In all of them there is probably also some mercerizing during the first stages of rinsing. Practice corresponds quite well with theory.

Checking the common observation made in practical work that it requires more force to bring back a yarn to length than it does to hold it there during mercerizing, it was found [5] to take twice as much weight to bring single fibers back as to keep them at the initial length. The corresponding figure in yarn mercerizing has also been given as twice.

Various figures have been presented for the effect of mercerizing on the strength of cotton. Yarn and cloth are usually strengthened by the process, but mercerized fibers are slightly weaker than unmercerized, as reported by several investigators.* The usual loss is from 5 to 7 per cent of the original strength. The effect is the same when mercerizing without tension, but the extensibility is then over 60 per cent greater. The gain in tensile strength of mercerized goods is not due to an increase in the tensile strength of cotton, but to other influences which will come under the heading of yarn.

Temperature has been a much argued question and mill experience has gone a little ahead of research. It is agreed that caustic should be reasonably cool, but in these days of caustic recovery, refrigeration does not usually contribute enough in either quality or economy to pay for itself.

REFERENCES

(5) J. T. I., 13, T 229; (6) J. T. I., 14, T 28 and 32; (7) J. T. I., 13, T 237; (8) J. T. I., 14, T 287; (10) J. T. I., 13, T 113.

*Since this article was written it has been noted that Clegg (J. T. I., XV, p. 6) reports experiments showing a gain in strength of cotton fibers mercerized without tension, ranging from 11.8 to 49.2 per cent, and a greater uniformity in strength, in contrast to the results quoted from Barratt, which showed a loss of strength. In view of the contradiction and the wide range of figures, it seems necessary to wait for further work before depending upon either set of figures.

Hanes Dye & Finishing Company has applied to the Secretary of State of North Carolina for a charter. The company has a paid-up capital stock of about $300,000, which is to be used in the construction of a new plant at Winston-Salem. Plans for the erection of the building, which is to be of brick, 120 by 240 feet, are being drawn in the Charlotte office of Lockwood, Greene & Co., engineers, of Boston and Atlanta. Bids for construction will be asked for soon.

The new company will dye piece goods, khaki goods for overalls, bags for vacuum cleaners, cloth tops for galoshes, upholstery for closed automobiles, and other cloths. The manager of the finishing department is H. A. Jolitz, of Charlotte.

Chemical Analysis in the Study of Cotton

New and Refined Tests for Cotton Impurities—Methods to Distinguish Different Kinds of Cotton—Suggestions for the Control of Bleaching Operations—Nature and Determination of Fat, Wax and Resin

By THOMAS CANTWELL

ENGLISH investigators have recently presented a number of very interesting and valuable papers under the general heading, "Chemical Analysis of Cottons." They are of special value to anyone making a fundamental study of cotton processing, and of bleaching in particular.

The methods are all rather highly refined but still not extremely complicated. The main features and applications will be briefly reviewed, but since the original communications occupy some seventy pages in several issues of the Journal of the Textile Institute, it is impossible to reproduce them all in detail. In cases where such methods seem applicable, the reader should look up the references given at the conclusion of this review.

One of the new tests is a carefully controlled application of Methylene Blue [1]. The investigation was first undertaken because of its importance in the problem of obtaining more accurate information about the Methylene Blue test for oxycellulose, and it soon became evident that anything approaching a quantitative investigation should take these new methods and results into account.

The work showed that all cotton, even the most carefully bleached, which is really pure cellulose, absorbs small but definite amounts of Methylene Blue. Since this absorption was found to vary in a consistent manner with the degree of bleaching and with the source of the cotton, it forms the basis of tests for both the quality of the bleach and the kind of cotton.

Unbleached cotton absorbs much more of the dye than bleached, the difference being due to its impurities. Their elimination is accompanied by a gradual decrease, as the "acidic constituents" are removed until an absorption is reached that is characteristic of the cotton itself.

Some of the more striking results are summarized.

The change with the bleaching process is very clearly brought out in samples taken after the different steps in a commercial bleach, the figures being millimoles of Methylene Blue per 100 grams dry American cotton.

Gray cloth	2.16
Lime boiled, soured	1.58
Lime boiled, soured, ash boiled, chemicked	1.04
Lime boiled, soured, ash boiled	1.04
Lime boiled, soured, ash boiled, chemicked, ash scald	0.58
Lime boiled, soured, ash boiled, chemicked, ash scald, chemicked	0.57

Each drop in the amount of blue absorbed occurs after a boil rather than after a chemic.

These and other examples show that the absorption is a measure of bleaching efficiency when variations are excluded due to the source of the raw cotton, the ash content, or formation of oxycellulose. It is understood that the methods of bleaching must be the same, or comparable, when testing for either quality of bleach or nature of the cotton.

Egyptian cotton absorbed a great deal more than American, whether the Egypt was grown in Egypt or Arizona, and Sakellaridis consistently showed twice the figure for American cotton.

Sixteen bleached American cottons gave comparative values from .43 to .60 but only four were above .50.

Six Egyptians, not Sakellaridis, were from .64 to .77, but only one above .70.

One Sakellaridis sample absorbed .92.

For such work the regularity is quite good.

Many details of the method of testing have been critically examined. Since the result will vary with the end concentration of the solution in which the cotton is being tested, the proper proportions must be very carefully followed. The blue absorbed was usually about 0.1 gram for 100 grams of normal bleached American cotton.

Where the results were to be measured by the colorimetric method, which is simpler than analysis of the dye solutions, the procedure was as follows. The cotton was first acid washed to remove the effects of ash alkalinity, by shaking for two or three hours in an N/10 solution of sulphuric or hydrochloric acid in large excess and then thoroughly washing out the residual acid.

"1.5 to 2 grams of cotton, cut into small pieces, were shaken for 18 hours in a glass stoppered bottle at room temperature with 50 c.c. of a solution of Methylene Blue hydrochloride containing approximately 0.4 millimole (molecular weight, 320) per liter."

Under these circumstances about half of the color is absorbed and the exact amount is estimated colorimetrically by comparison with a known solution. For Egyptian cotton only half the given weight of sample is taken, and for raw cottons it is necessary to start with stronger dye solutions.

Where soaps or soluble oils are used in boiling, the absorption is increased if they are left in the cotton in the form of insoluble soaps. In fact, the test can be adapted for a delicate test for such combined fatty acids.

While it would seem that the test must depend, in pure bleached cotton, on some surface effect, it is a strange fact that calendering or mercerization, which certainly affects the surfaces of cotton fibers, is without influence on the Methylene Blue absorption.

Standard Method for Copper Number

Copper number may be defined as the weight of copper reduced by 100 grams of the sample from the cupric to the cuprous state under standardized conditions. It is a recognized test for "modified cellulose" which is usually characterized by a reducing action.

Copper number is an analytical "constant" of cotton that has been much discussed, but the different methods suggested for its determination have not agreed, and the results have frequently been subject to variations caused by very slight variations in procedure. The several better known methods have been very carefully examined, and that attributed to Braidy and also described by Koehler and Marqueyrol, selected as fulfilling the desired conditions: (I) that there should be but a small blank test when carried out without any cotton; (II) pure cotton should yield only a minimum figure; (III) even slightly modified cellulose should give quite appreciable values, i. e., the test should be sensitive; (IV) the test should be reproducible; (V) the method should be very readily carried out.

The standard method is quoted in full [2] a notable feature of it being the avoidance of Fehling solution.

The following solutions are used in the determination:

(a) Pure copper sulphate, $CuSO_4.5H_2O$. . 100 grams
Water .....to 1 liter
(b) Sodium bicarbonate .....50 grams
Crystallized sodium carbonate.....350 grams
Water .....to 1 liter

Immediately before use 5 c.c. of solution (a) are run from a burette into 95 c.c. of solution (b), the mixture is raised to the boil and poured over 2.5 grams of the material to be examined, contained in a conical flask of capacity only very slightly greater than 100 c.c. By means of a glass rod the cotton is distributed through the liquid and any air bubbles are allowed to escape, after which the flask is closed with a pear-shaped glass bulb and immersed in a rapidly boiling, constant-level water bath. The flask should be deeply immersed in the water, and care should be taken to cover the top of the bath sufficiently to prevent cooling of the reaction mixture by currents of cold air; several determinations may, of course, be carried out simultaneously in a suitable bath. The flask is allowed to remain in the boiling water for exactly three hours, the contents are then filtered with suction, and the cotton impregnated with cuprous oxide is washed, first with dilute sodium carbonate, and then with hot water. The cuprous oxide is dissolved by treating the cotton on the filter with the following solution:

Iron Alum .....100 grams
Concentrated sulphuric acid .....140 c.c.
Water .....to 1 liter

Two portions of the solution, of volume 15 c.c. and 10 c.c. respectively, are usually sufficient for this purpose, though a further treatment with 10 c.c. may occasionally be necessary in the case of highly reducing products. The cotton is then washed with 2N sulphuric acid, and the combined filtrates and washings are titrated with standard potassium permanganate solution of concentration approximately N/25, corresponding to about 2.5 mg. of reduced copper per cubic centimeter. The end-point of the titration is sharp and stable.

A very full critical discussion and notes on application of the results are included in the original paper.

Phosphorus—Index of the Source of Cotton

The phosphorous content is a matter of some importance with raw cotton, and it will serve to distinguish between cottons of different origin. The method might have specific application where a cotton is suspected of being tinted to imitate Egyptian. So far the work [4] has been confined to unbleached cotton as a large proportion of the phosphorus is removed even on washing with water.

	Phosphorus as pentoxide Per Cent
Eight American samples averaged.....	0.051
Eleven Sea Island samples averaged.....	0.067
Three Sakellaridis samples averaged.....	0.119
Seven other Egyptian samples averaged..	0.094
Six South American samples averaged...	0.068

The figures will vary somewhat with environment of the growing cotton, and at different parts of the manufacturing operation, but not sufficiently to prevent distinguishing between American and Egyptian varieties. It might be noted that cotton in the bale is variable, but as soon as it is mixed, during the first few manufacturing operations, it becomes uniform and quite constant.

It is noteworthy that the phosphorous content in *raw* cotton runs roughly parallel with the Methylene Blue absorption on *bleached* material, which is almost entirely free from phosphorus.

The phosphorous content varies between 0.04 and 0.13 per cent (as pentoxide), and when only small samples of cotton are available it may be necessary to estimate quantities of the order of a tenth milligram. There are previous known methods for estimating minute amounts of phosphorus, but after examining them the best results,

(*Continued on page* 699)

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SEPTEMBER MEETING OF THE NEW YORK SECTION

Following the usual informal dinner the regular September meeting of the New York Section of the American Association of Textile Chemists and Colorists convened at Stewart's Restaurant, New York City, at 8.15 Friday evening, September 26, 1924, Herbert Grandage, presiding.

After the formal business of the Section was transacted, Vice-Chairman Grandage introduced the speaker.

Chairman Grandage—I think we will go directly ahead now with the subject for discussion for the evening. Howard L. Tiger, of the Permutit Company, will present for us the subject "Water and Its Relation to the Textile Industry." After Mr. Tiger has presented his paper we are going to have one or two gentlemen present for us the application of that particular subject to three phases of textile work in which we are most interested: cotton, silk, and wool.

Unfortunately, Mr. Wood is not able to be with us; he has gone to Boston to the Council meeting. We are rather in hopes that some of the men here to-night who know silk and know something about this subject in connection with silk will help us out at that point and bring forth whatever subject matter they have at that time.

WATER AND ITS RELATION TO THE TEXTILE INDUSTRY

By HOWARD L. TIGER
Permutit Company

[NOTE.—*During the presentation of this paper twenty-one lantern slides were shown to illustrate the apparatus and the principles dealt with. Several of the most important and most interesting illustrations are here reproduced where they are referred to in the text.*]

It is a well known fact that water in the textile mill has a great variety of industrial uses, such as scouring with soap and detergents, dyeing, bleaching, mercerizing and feeding steam boilers. That the character of the water supply is of great importance to the industry has been recognized for many decades. In fact, this consideration has been one of the principal ones in controlling the geographic distribution of the industry, and we therefore find our great textile centers in this country generally located in the Eastern and Southern States, where the water supplies are abundant and comparatively good.

During more recent years it has been found that great economies and improvements in quality can be effected by further purification of these water supplies which were previously thought satisfactory in their natural state. This change of attitude has been largely brought about by the great improvements in the methods and equipment used in water purification. The net result of these improvements has been a great decrease in the installation and operating costs of water purification plants and a great increase in the operating simplicity of these plants and the quality of water produced.

This progress in the field of water purification is not only resulting in the improvement of water supplies

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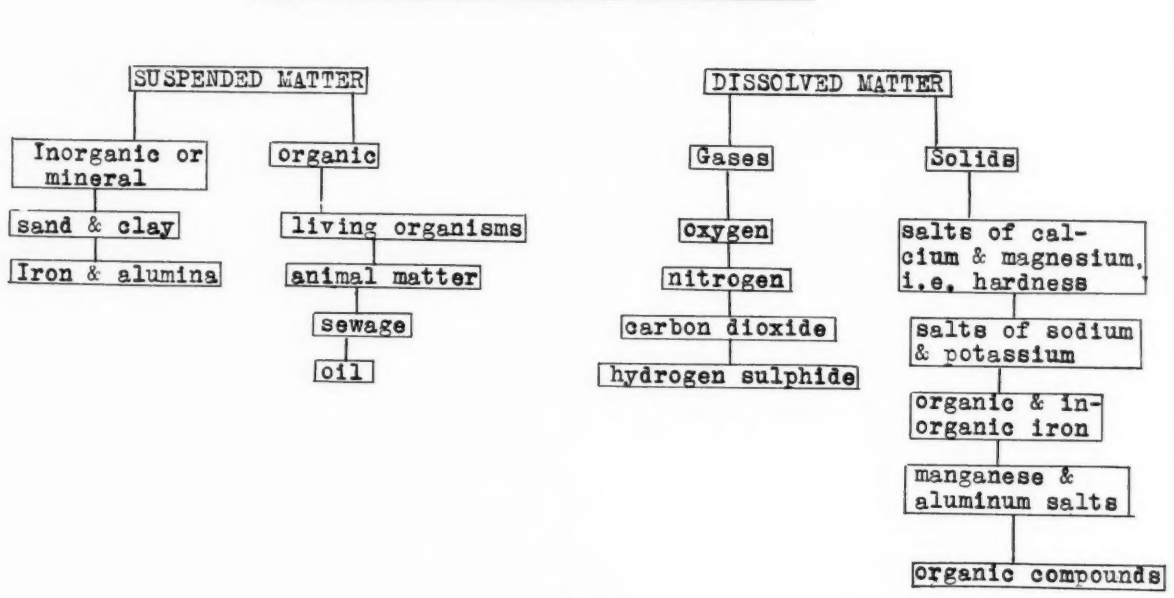

FIG. 1

and textile products in the established textile centers, but it is also making the textile industry independent of location so far as such geographic distribution has been influenced by the quality of the water supplies available.

In choosing a mill site it was formerly necessary to consider whether a complicated water-treating plant would be required, particularly if the water supply available was hard and required softening. Frequently locations that were otherwise attractive were abandoned because of hard water, experience having proven that even with careful supervision the results from the water-treating processes then in existence were only mediocre.

These conditions have changed. It is now an established fact that almost any natural water can, by simple treatment, be rendered equal to the best of supplies for the wet-processing of textiles. It is only necessary to consider the cost of treatment and the fixed charges on the investment for the proper water-treating system and to balance these items against the advantages of location, such as the availability of labor, cost of power, proximity to raw materials and to the market for the finished product, etc. There is no doubt that if the water supply problem is considered in this light as a cost of manufacture it will open the eyes of manufacturers to other advantages that far outweigh the slightly higher cost of producing perfect water in many localities hitherto considered unfavorable because of the character of the water supply.

The natural question which suggests itself after these general statements is: What are these developments that have simplified water purification, reduced costs of installation and operation, and produced such vast improvement in the results of treatment?

It is my purpose in the short period at my disposal to sketch briefly the principles involved in the various methods of water purification and to indicate how the art has advanced to the present state. To make this clear without spending too much time on fundamentals with which you are probably familiar, diagrammatic charts and illustrations will be used where possible.

NATURE'S WATER CYCLE

[*Slide: Fig. 1.*] You are undoubtedly familiar with the cycle which exists in nature; the sun beating down on the surface of the earth evaporates the water and forms the clouds, and these later precipitate to form rain. The rain falling to the surface of the earth forms the natural sources of supply which are available for use: the surface waters in the forms of lakes and rivers and streams, and the ground waters in the forms of wells and mine waters.

We know that the water as it passes through the atmosphere on its way to the earth gathers certain impurities, principally these gaseous impurities shown here—oxygen, nitrogen, carbon dioxide and hydrogen sulphide. With these impurities in solution, the water which percolates through the crust of the earth is able

to dissolve out certain other impurities from the rocks with which it comes in contact and which we have classified here under the dissolved solids.

The other water which lies on the surface of the earth in the form of streams and lakes, of course, read-

FIG. 2

ily picks up impurities which can be carried into the water by mechanical means. The erosion by the stream passing through its bed brings sand and clay and iron and alumina salts into the water, and from the various industries lining the streams waste materials are collected.

Of course, the suspended matter can always be detected by simple comparison with standards. The organic matter in suspension or solution is usually determined by the permanganate consumption of the water.

The amount of carbon dioxide is, of course, readily determined by the amount of alkali which the water consumes in the presence of phenolphthalein; and the hydrogen sulphide can be detected by its odor and quantitatively by lead acetate.

The next group is the dissolved solids. The salts of calcium and magnesium which constitute the hardness can be determined by the amount of soap they consume. We all know that the calcium and magnesium salts react with soap to form insoluble compounds, and therefore the amount of such salts which are present can readily be determined by the soap-consuming power of the water.

The organic and inorganic iron, which we have classified here, are the two forms in which we usually find iron present. In a surface supply, the iron is most frequently present as complicated organic compounds, tannates and the like. These are the compounds that impart the high color to surface supplies. Some of these very highly colored surface waters are frequently referred to as "cold tea," because they become so brown.

The inorganic iron, on the other hand, usually occurs in well waters, and this iron is present in the form of the ferrous bicarbonate. The characteristics of these well waters are that when the sample of the water is drawn it is usually clear, but when it is permitted to stand for any length of time in the open air and the CO_2 holding the iron in solution escapes, it permits the iron to precipitate as the hydrated oxide. That is why you can usually recognize one of these chalybeate well waters by taking a sample of the water and allowing it to stand in a vessel in the open; you will find, if iron is present, it will precipitate within anywhere from a half hour to an hour. That action can be accelerated by sunlight, so that we have at our disposal a simple means of testing the presence of iron in a deep well water.

TROUBLES FROM IMPURITIES

We are more or less familiar with the difficulties that are encountered due to the presence of these various impurities. I shall refer to them particularly, as they cause difficulties in the textile industry.

The suspended matter, of course, is objectionable in textile work because it prevents the production of a clean product, and therefore it is always necessary to remove it if one wishes to obtain the best results in the process work.

With the dissolved matter, among the gases, the oxygen is rather objectionable, because it is the principal cause of corrosion in pipe lines and boilers.

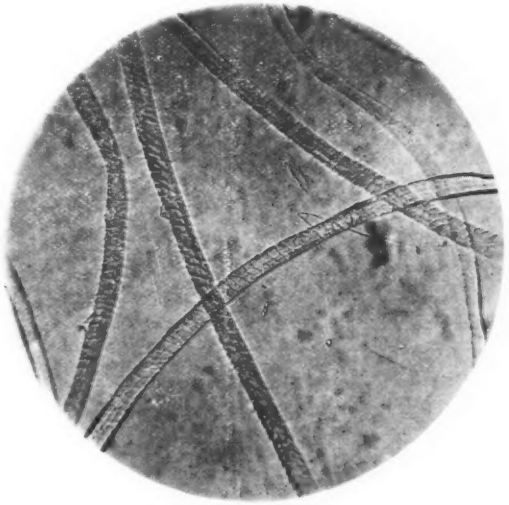

FIG. 3

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CHEMICAL REACTIONS IN WATER PURIFICATION

Alum Coagulation

$$3\ Ca(HCO_3)_2 + Al_2(SO_4)_3 \longrightarrow 2\ \underset{\text{floc}}{Al(OH)_3} + 6\ CO_2 + 3\ CaSO_4$$

Lime-Soda Softening

$$Ca(HCO_3)_2 + Ca(OH)_2 \longrightarrow 2\ CaCO_3 + 2\ H_2O$$

$$MgSO_4 + Ca(OH)_2 \longrightarrow Mg(OH)_2 + CaSO_4$$

$$CaSO_4 + Na_2CO_3 \longrightarrow CaCO_3 + Na_2SO_4$$

Zeolite Softening

$$Na\ zeolite + \begin{matrix}Ca\\Mg\end{matrix}\ salts \longrightarrow \begin{matrix}Ca\\Mg\end{matrix}\ zeolite + Na\ salts$$

Regeneration

$$\begin{matrix}Ca\\Mg\end{matrix}\ zeolite + NaCl \longrightarrow \begin{matrix}Ca\\Mg\end{matrix}\ chlorides + Na\ zeolite$$

FIG. 4

Oxygen has not yet been economically removed on a large scale, so that it pays to treat the entire water supply; but for boiler feed purposes it can be readily removed by simply heating the water to the boiling point, at which temperature the gases are rendered insoluble, and if the heater is provided with a vent they pass off to atmosphere. In that manner the oxygen is removed from the boiler feed water and the water will then not corrode the boiler.

In the past the carbon dioxide has been believed to be the cause of corrosion, but many investigations which have been recently carried on have proven that the principal factor is the oxygen and that the carbon dioxide, if present in addition to the oxygen, may simply accelerate that corrosive effect, but the carbon dioxide itself does not cause corrosion.

Referring now to the group of dissolved solids, we have the substances which most commonly occur in natural water supplies—the salts of calcium and magnesium, which are known as hardness. These, as we all know, cause a number of great difficulties in the textile industry. We know that wherever soaps come in contact with lime or magnesia salts the insoluble precipitates are formed, and where such insoluble soaps are formed they immediately attach themselves to the fibers and adhere. During all the subsequent processes these soaps interfere with the quality of the product.

[*Slide: Fig. 2, Fig. 3.*] These photomicrographs illustrate the insoluble soap deposits on wool fiber processed in hard water (Fig. 2) and the clean surface of the same materials (Fig. 3) processed in water from which the hardness has been completely removed.

It is also true that these calcium and magnesium salts form insoluble compounds with many classes of dyestuffs, and, of course, with such dyestuffs the adverse effect of the presence of the lime and magnesia is noticeable immediately. With the other dyestuffs that do not form the insoluble compounds, the actual precipitations do not occur in the dye baths, but these insoluble soaps which have attached themselves to the fibers in the previous processes (the soap scouring processes) interfere with the even dyeing in the actual dyeing work.

In feeding boilers with hard water, the formation of

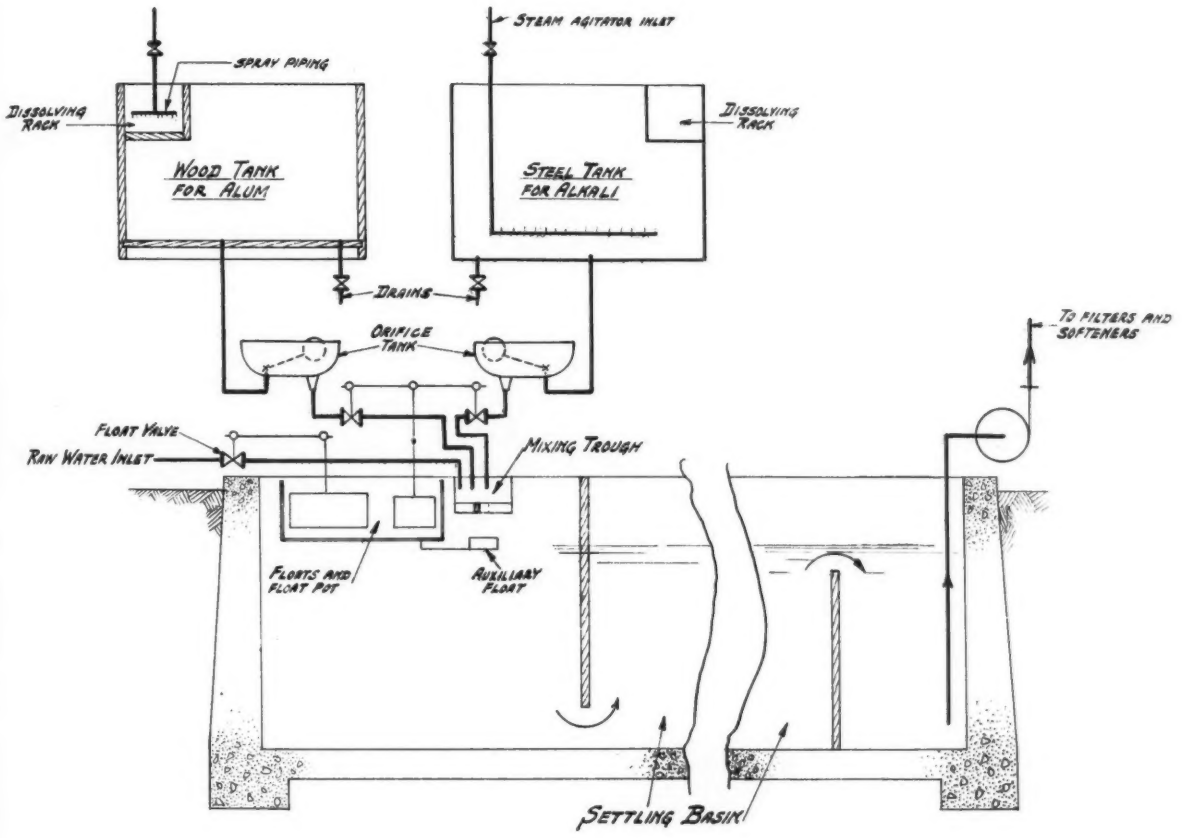


FIG. 5

scale with its attendant fuel losses are well known. Furthermore, the presence of the scale is dangerous because it often causes bagging and blisters on the tubes. Such blisters are usually caused by the presence of scale on the interior of the tube which requires a higher temperature in the fire, and sometimes this temperature becomes so high that the metal actually becomes fluid and in such cases at the points where the metal becomes hottest the pressure in the interior of the tube forces the metal out and makes a blister and, of course, in many cases it actually causes a rupture.

PRINCIPLES OF WATER TREATMENT

In order to cover what may be familiar ground to many of you, I thought we would put these chemical reactions on a slide. These chemical reactions cover briefly the principles involved in the various methods of water purification.

[*Slide: Fig. 4.*] The first reaction which you see up here (the alum coagulation) is the treatment commonly used in connection with mechanical filters for the removal of suspended matter. The natural bicarbonates in the raw water react with the alum or sulphate of alumina to produce the aluminum hydrate or floc, plus CO_2 and some calcium sulphate. It is this floc which attracts to itself the finely divided suspended matter and the color in the water, thereby converting these finely divided and dissolved materials into a large particle which can be readily strained out of solution by the filter. We will go into the apparatus applications of these principles later.

The next reaction illustrated is softening by the lime soda process. The bicarbonate of calcium is precipitated by the addition of calcium hydrate or hydrate of lime, to form the insoluble calcium carbonate and water. The insoluble calcium carbonate settles out and that remaining in suspension is later removed by a filter.

The calcium sulphate plus whatever other soluble cal-

cium salts there are in solution react with the sodium carbonate to form the insoluble calcium carbonate and the corresponding sodium salts. The magnesium salts react with the calcium hydrate to form insoluble magnesium hydrate. Thus, the insoluble compounds formed in the lime-soda process are calcium carbonate and magnesium hydrate.

The next reaction is that which takes place in zeolite water softening. Here we have a mineral which is practically insoluble in water and which is suitably supported in a container in the form of a bed. The water percolates through this mineral and the reactions which you see here take place automatically. The sodium zeolite, the insoluble compound, reacts with the calcium and magnesium salts, irrespective of which salts they are, to form the calcium and magnesium zeolite, the sodium salts passing on in the effluent. The sodium salts do not form any precipitates with soap; they do not react with any dyestuffs to form insoluble compounds; and in boilers they do not form any scale. Water containing only sodium salts is, therefore, absolutely soft and eliminates the difficulties which were referred to under hardness.

As noted above the principle of lime soda softening involves the precipitation of these insoluble compounds. Therefore, the best that we can expect to produce in the effluent of the lime soda softener is a hardness which is below the solubility point of these compounds. Take calcium carbonate, for example. Its solubility runs about thirty or forty parts per million and therefore you are bound to have that much of the material remaining in solution after your reaction has been carried as far as it can be in the actual precipitation. Similarly, the magnesium hydrate has a certain solubility somewhere around twenty or thirty, that is, with the usual excesses of chemicals which can be present in water purification. So you have a total of anywhere from sixty to eighty parts per million of hardness passing out with the effluent of the lime-soda water softener. It should be made clear that this amount of hardness remains in solution in the presence of small excess of chemicals which is allowable in water treatment.

With the zeolite softener, since your reacting mineral (the sodium zeolite) is practically insoluble in water, you can have a tremendous excess of this material present, without any of it going into the effluent. Consequently, you can carry this reaction to completion, all your calcium and magnesium salts being removed leaving the water absolutely free from hardness.

If an attempt is made in lime-soda treatment to carry

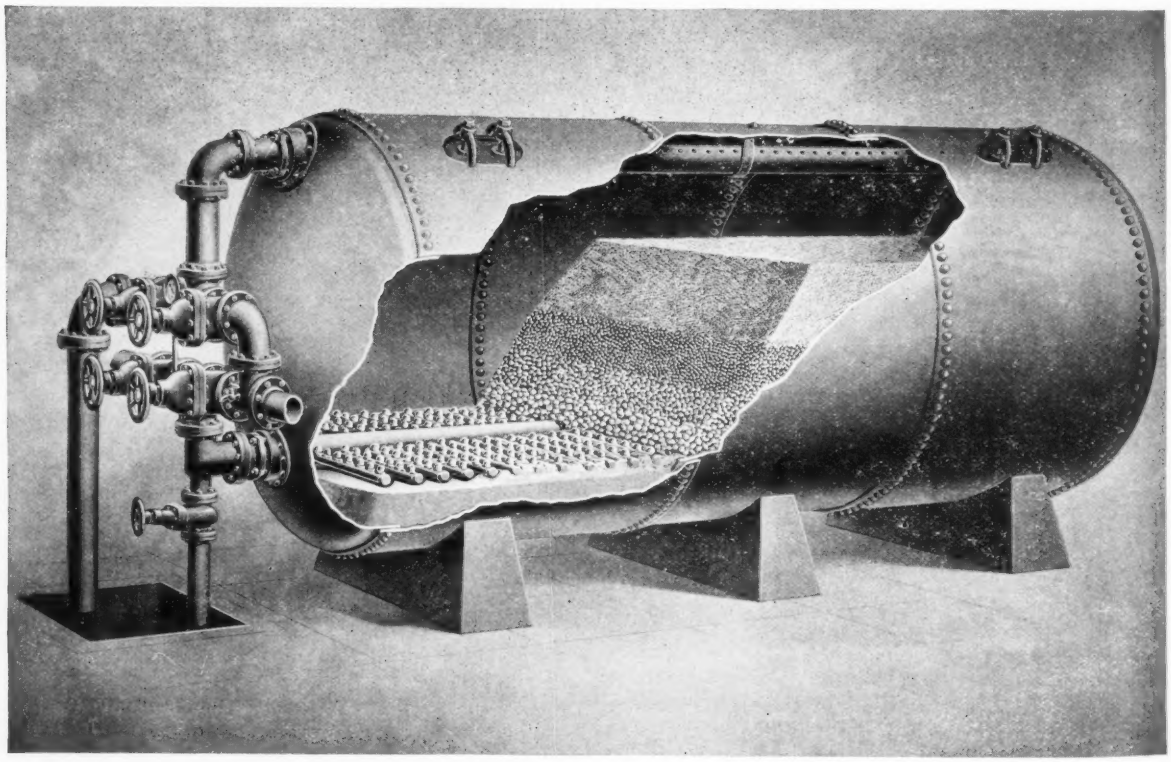


FIG. 6

the reactions further, or if care is not exercised in the dosage of chemicals, the effluent may contain excesses of these soluble chemicals, which is a very dangerous condition for textile process work. This cannot occur with the zeolite softener because the softening medium is practically insoluble in water.

After the zeolite has been completely exchanged, that is, after it has absorbed all the lime and magnesium salts which it can, it is regenerated, which means bringing it back to its original condition by treatment with a solution of sodium chloride. That simply reverses the reaction.

A number of years ago the common method of removing the suspended matter and even color was by slow sand filtration. In this system the sand used was of very fine size, and the rates of filtration were very low. This practice called for large filter areas and the initial costs on such plants were therefore high, the space requirements were great and manipulation difficult.

The removal of fine turbidity and color with larger-sized grains of sand and therefore at higher filtration rates, was made possible by the introduction of coagulants. This scheme of pretreatment before filtration made it possible to use the coarser sand and to step the filtration rates up to about 2.5 gallons per square foot per minute so that the filtration areas, the ground space and the initial costs were decreased tremendously.

Incidentally, the average rates in the slow sand filter plants were about one-tenth of a gallon per square foot per minute. That is about one twenty-fifth as fast as the rates used in rapid sand filtration. Consequently, the areas required to filter a given number of gallons in a unit of time by the rapid sand filters are about one twenty-fifth as great as the areas required by the old slow sand filtration methods.

These filters operating at the higher rates of filtration are called mechanical filters to distinguish them from the slow sand filters. Coagulation has made mechanical filters possible because the floc adsorbs fine turbidity and color and holds them in the form of a large particle which can be completely and readily filtered out by the coarser sand. If this fine turbidity and color were not coagulated before filtration, most of it would pass through the interstices between the sand grains and appear in the effluent of the filter.

The coagulant most commonly used in water purification at the present time is sulphate of alumina. For complete coagulation it is necessary to allow the coagulant to react with the water for some time before admitting the water to the filters. The practice on industrial purification has been to allow a coagulating period varying anywhere from four hours down to nothing. Since the formation of the floc requires some time, it cannot be expected to produce the best results without some coagulation period. Furthermore, the use of a settling basin before filtration reduces the burden on the filters because much of the suspended matter and the coagulant settle to the bottom of the basin and it is then only necessary to filter out the residual floc in suspension.

[*Slide: Fig. 5.*] I have an illustration here of a typical concrete setting basin with gravity chemical feeds for the alum and alkali. There is a wooden tank for the alum solution, and the rate of feeding alum to the water can be controlled by opening the orifice a given distance. The orifice on such a device has a graduated bronze dial so that it can be set at any definite opening which discharges a given volume of chemicals, the orifice being calibrated. This type of feed, by the way, is a constant, manually operated chemical feed. That is, if any variation in the quantity and the rate of feeding chemicals to water is to be made, it must be done by hand on this orifice.

The chemicals entering the water mix with it in a mixing trough which is constructed at the top of the basin and which can also be constructed of concrete with wooden baffles, so that the chemicals and water take a circuitous path as they travel through the length of that mixing trough on their way to the basin inlet.

If the supply of water to the mill stops—that is, if no more water is required in the mill—naturally the water level rises in this basin until it overflows the pot, at which time these floats come up, and the raw water and chemicals are cut off by means of the main and auxiliary floats. The water, after it has received its dose of alum and alkali, if any is required, passes into the basin, as I said before, and this basin is equipped with baffles so that the water must pass under them in some places and around them in other places. The purpose of baffling the basin is to prevent short-circuiting of the water flow.

Much progress has been made lately toward improving coagulation results and cutting down settling periods by the proper chemical adjustment. It was only very recently recognized that too much alkali in coagulation is just as bad as too little, and that the best coagulation takes place between definite limits of alkalinity and acidity.

You will recall the chemical reaction where the alum reacted with the bicarbonates in the water to form the insoluble floc. If you had a water like many of these New England waters, which are very low in alkalinity and high in color, and you needed a considerable amount of alum to coagulate that color; if you added the alum directly to the water without adding any alkali to form the floc, the alum would simply go into solution and would give you a water containing the acid salt in solution. Such a water would be detrimental to the piping systems, and when it got into some of the dye

baths where soaps or alkalis were added, or into the scouring processes, would give very, very bad results.

In order to avoid this it is necessary to give the alum the alkalinity which it needs. This is done by feeding soda ash when the alkalinity is too low. There is a definite ratio between the amount of alum fed and the amount of alkalinity required, one part of alum sulphate requiring one-half part of methyl orange alkalinity. Thus, by analyzing the raw water and knowing the amount of alum which must be fed, you can readily determine whether you have to feed any artificial alkalinity to get your reactions complete.

In former times if the alum coagulation was incomplete, it was the custom to add more soda ash to improve the coagulation. This was often unsatisfactory because excess alkalinity can do just as much harm to the coagulation as insufficient alkalinity. That is a point which is just beginning to be recognized, and as a matter of fact I have been many times surprised at the number of large plants which are operating at this very day with improper dosage of the alum and alkali, and which are losing the benefits of large and expensive filtration systems just because they don't know anything about that adjustment, or if they do know it they are overlooking it.

With proper coagulation, effective filtration becomes a simple matter. [*Slide.*] We have here an illustration of a common sand filter. This is a mechanical pressure filter of the vertical type; that is, the shell stands vertically. In the bottom of the filter we have concrete which supports a piping system. A large header extends the length of the filter and into this header are screwed laterals, and into the laterals are screwed little brass strainer caps; and this whole strainer system is imbedded in concrete. On top of the strainer system come the various grades of gravel and coarse sand, and on top of that the fine sands. These layers are merely supporting layers for the fine sand which actually does the filtration work, and the grading that you have when you originally fill a filter remains there because when you back-wash the filter later these fine materials naturally grade themselves out on top.

We have another illustration of a horizontal filter. [*Slide: Fig. 6.*] This is the type of filter which is used where large amounts of water are to be filtered, because it presents a larger filtration area for a given tank volume; that is, for a given expenditure of steel you can get more filtration area out of a tank of this sort, laid on its side.

Here we again see the grains of the gravel and the sand just as we did in the other, and the valves at the left are merely the operating valves. I think it is apparent how those valves control the flow of water downwardly through the filter. This perforated pipe admits the raw water through the top of the filter; the suspended matter is collected here and the water collects evenly in this strainer system at the bottom and goes out through this pipe to the filtered water lines in the mill. After the bed has collected its suspended matter on the surface these two valves are closed.

When the filter is clogged up, those two valves are closed and the back-wash inlet valve is opened; the water comes up through the bottom of the filter, carries the suspended matter out through this back-wash collector pipe, and it goes out from here to the valve opening to waste.

After the back-wash operation is completed, the flow is again reversed and the water is passed downwardly through the bed, and instead of passing it directly to the mill it is first passed out to waste until it becomes clear, which usually takes a minute or two, and then this valve is shut and the filtered water outlet valve is opened again.

In the mechanical pressure filter the water is pumped through the filter under pressure to service. The other type of mechanical filter is the open gravity type usually constructed of concrete.

It has been claimed that better results are produced with gravity filters than with pressure filters, but in these comparisons the error has often been made of comparing properly designed and operated municipal plants of the gravity type with improperly designed and operated industrial plants of the pressure type. There is no particular reason why the mere application of pressure should affect the quality of the effluent of a filter, provided the pretreatment and rates of filtration are the same in both cases. It is true that the pressure filter can be abused by forcing water through it at a high rate, but if the plant is properly designed for the maximum capacity required there is no danger on this score. The great advantages of pressure filter plants for industrial purification are the much lower initial cost and the elimination of repumping, with the accompanying loss of power that is often required by the gravity installation. Furthermore, the flexibility of the pressure plant to deliver unexpected capacities is a distinct advantage in industrial work, because the danger of small amounts of bacteria slipping through the filter is of no concern as it is in the case of municipal filter plants.

We pass from the subject of filters to the apparatus used in water softening. At present there are two principal methods of removing hardness from water, those methods which we illustrated before—the lime soda and the zeolite. We have here a few illustrations of typical lime soda plants. These lime-soda plants, by the way

are getting to be obsolete in the textile industry because of the objections which we considered before, but we will go over the general construction of such a plant briefly. (Mr. Tiger then went into a detailed description of a lime-soda plant and illustrated his explanation with slides not shown here.)

The principal objection to lime soda treatment for textile work is that at best it produces a five-grain effluent, which is harder than many of the Eastern supplies that are being completely softened to advantage by the zeolite process. Furthermore, the lime soda plant requires chemical skill for its operation, particularly on a variable water supply. Also it requires large amounts of ground space and involves the danger of excess chemicals in the treated water.

The next illustration [*slide*] is one of the simple zeolite softener. The water just percolates through the zeolite. By the time it reaches the strainer system the calcium and magnesium salts in the water have been completely absorbed by the bed so that the water leaving the strainer system is completely softened and passes out to service. When the capacity of the zeolite softener is exhausted as indicated by a meter these inlet and outlet valves are shut down.

. . . (Mr. Tiger then explained in detail, pointing out the different parts on the illustration, the operation of this zeolite softened.) . . .

After the short period of back-wash the valves are closed again and the brine inlet valve is opened.

After the regeneration is completed we have one more step to go; the raw water inlet is again opened and the exhausted brine is rinsed out of the bed to waste until the water coming out of the waste valve is free from hardness, as indicated by a simple soap test.

The operation of the zeolite softener is very simple. The capacity of such a softener is the product of the volume of water treated by the hardness of that water, and there is never any danger of overtreatment because the mineral is practically insoluble in water. This also makes it possible to have a great excess of mineral present so that the hardness can be completely removed. Furthermore, these plants are very compact and can be directly connected into a pressure system without the need of repumping.

There are at present two general types of zeolite which are being largely used: the porous and the non-porous zeolite. The porous zeolite has the advantage of having a slightly higher exchange value; that is, it can absorb more hardness before its capacity is exhausted. On the other hand, the porous zeolite is more easily affected by aggressive waters or waters containing small amounts of suspended matter, because the pores become clogged up with this suspended matter and thereafter the capacity of the zeolite is considerably reduced. Consequently, when the water is fairly aggressive or contains slight amounts of suspended matter, as most of our Eastern and city water supplies do, it is advisable to use the non-porous zeolite, which I say has the lower reacting power and therefore requires a slightly larger shell, but which, on the other hand, is more rugged so that it can resist the action of these suspended matters or the aggressive qualities of the water.

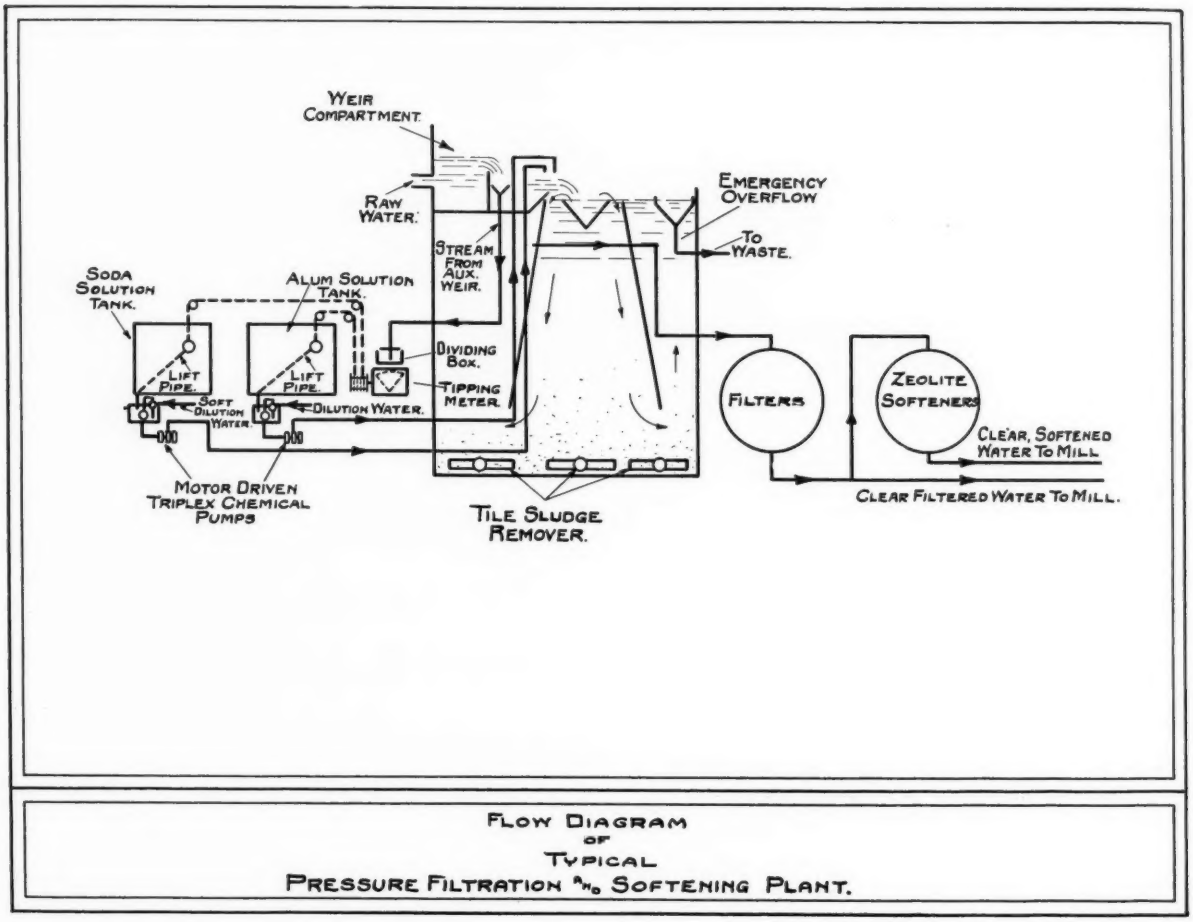
Outside of that, the principles of application of the two zeolites in the softener and the softener itself are identical. The only difference is that on account of the lower exchange value of the non-porous material, the solid zeolite, you need a larger container to get the same capacity.

Another advantage of the solid zeolite is that it can be regenerated with the brine very rapidly—in fact, almost instantaneously—because all the reactions have taken place on the surface of the particles, whereas in the case of the porous zeolite the reactions have gone into the interior of the pores and consequently the regenerating period which must be allowed is also greater in order for the brine to reach the interior of these pores.

[*Slide.*] That shows two bottles of water. This is supposed to represent the soft water, that is, a water softened by zeolite; after you add a few drops of the soap solution and shake it up you get this lather on the surface, and you notice that the water here is absolutely clear, whereas with the hard water, when you add sufficient soap to form the lather on the top, you have this milky suspension throughout the liquid. That is an illustration of the way the insoluble soaps form when you add soap to water containing hardness.

[*Slide.*] That is a view of a zeolite plant. This is the battery of softeners over here, and on the other side are the filters and the manganese remover filters over here.

[*Slide: Fig. 7.*] This is a flow diagram of a typical pressure filtration and softening plant. It is a type that has been recently installed in a few textile mills, and under conditions of practical operation has been found to be about as close to automatic and foolproof as anything yet devised. The general principles of chemical feeding are those which we discussed under the lime soda softener before. The raw water enters at the top of the settling tank, and in this case we have a weir compartment for the control; that is, the main stream, and the little auxiliary stream, or the stream from the auxiliary weir, are controlled here by weirs instead of by orifices in the bottom of the head-box as we had it before. The main stream of water flows through this trough into the downtake over the conical baffle. The



FLOW DIAGRAM
OF
TYPICAL
PRESSURE FILTRATION AND SOFTENING PLANT.

FIG. 7

auxiliary stream flows to the dividing box on the tipping meter, and the tipping meter controls the chain which holds the lift pipes in the chemical tanks and permits the chemical solutions to come into the dilution tanks from which they are pumped to the raw water at the inlet to the basin. As you see, the water travels downwardly through the conical downtake and the precipitates form at the bottom of the tank, and in this case are removed by an intermittent tile sludge remover. The water, with most of the suspended matter settled out, passes up to the collector pipe which is diagrammatically illustrated here, and from there flows by gravity to the filters.

A portion of the filtered water passes through the zeolite softener to the mill. I say a portion, because in the large mills there are a number of processes which require water that is absolutely soft, whereas there are a number of other processes that can get along with the unsoftened water. In such cases it becomes economical to have separate pipe lines, to those branches of the work that require the soft water, and to supply the remainder of the mill with a clear, filtered, unsoftened water.

I think that gives you a clear picture of the way in which the water flows through one of these modern plants, right through the filters, and directly through the zeolite softeners. About the only thing an operator has to do here is to come over and fill his chemical tanks up when they have discharged their contents. The flow of water to the settling tank is usually controlled by a float valve or float switch on the pump, so that the entire plant stops and starts automatically.

The zeolite softener, of course, requires backwashing and regeneration once a day or at intervals for which its capacity is designed, and the filters usually require backwashing about once a day.

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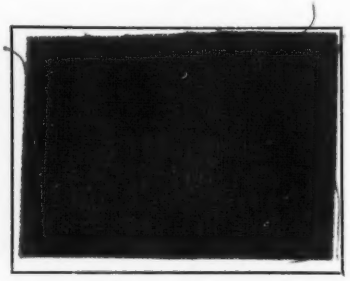

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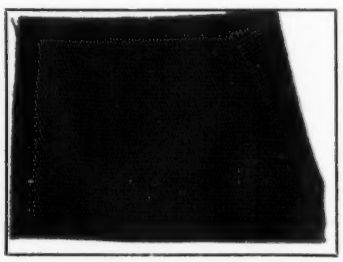

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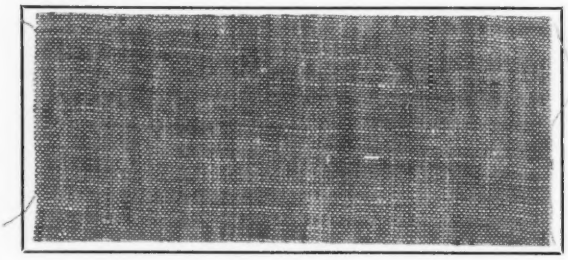

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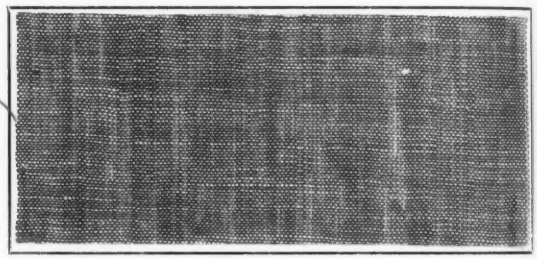

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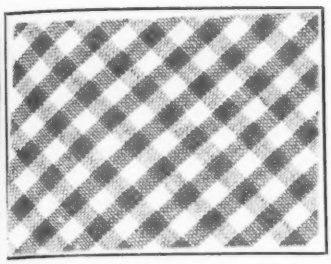

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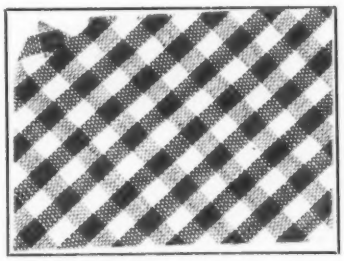

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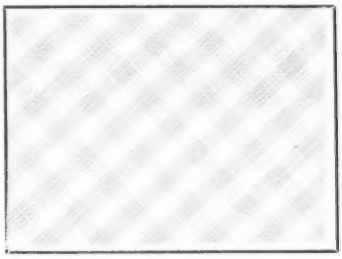

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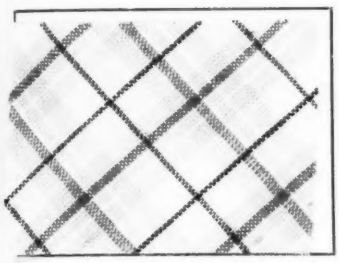

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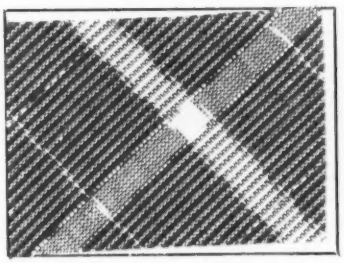
ANTHRENE BLUE GCD



ANTHRENE JADE GREEN
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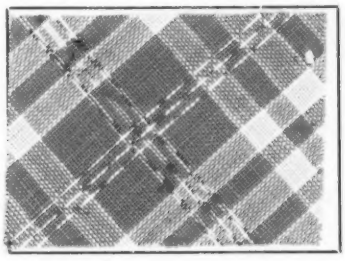

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PINOL

Used chiefly as an assistant in kier boiling, for quick wetting out of all kinds of vegetable fibres, and as an assistant in bleaching and mercerizing.

ISOMERPIN

Chiefly recommended for its wetting out properties on all kinds of fabrics and as an assistant in bleaching and dyeing.

NEOMERPIN N

Is absolutely fast to acid and can be used in the acid bath in dyeing wool colors. It is especially recommended as an assistant in the dyeing of Chrome or Alizarine colors.

NEOMERPIN

An assistant in the reduction and dyeing or printing of vat colors. The wetting out properties are similar to Pinol and Isomerpin, and used in the dyeing of piece goods or any material in the closed type of machine, Neomerpin is a valuable aid in both penetration and levelling. It is absolutely proof against lime and can be used in very hard water.

POTT'S EMULSIFIER

A compound that can be mixed with any of the oils used in textile mills, such as wool oil, lubricating oils, loom oils. A mixture of 25% Pott's Emulsifier with the oil in question will produce a compound which can be washed out in clean water even though the material has been stored for a long time. It is also useful for removing spots of various kinds from materials.

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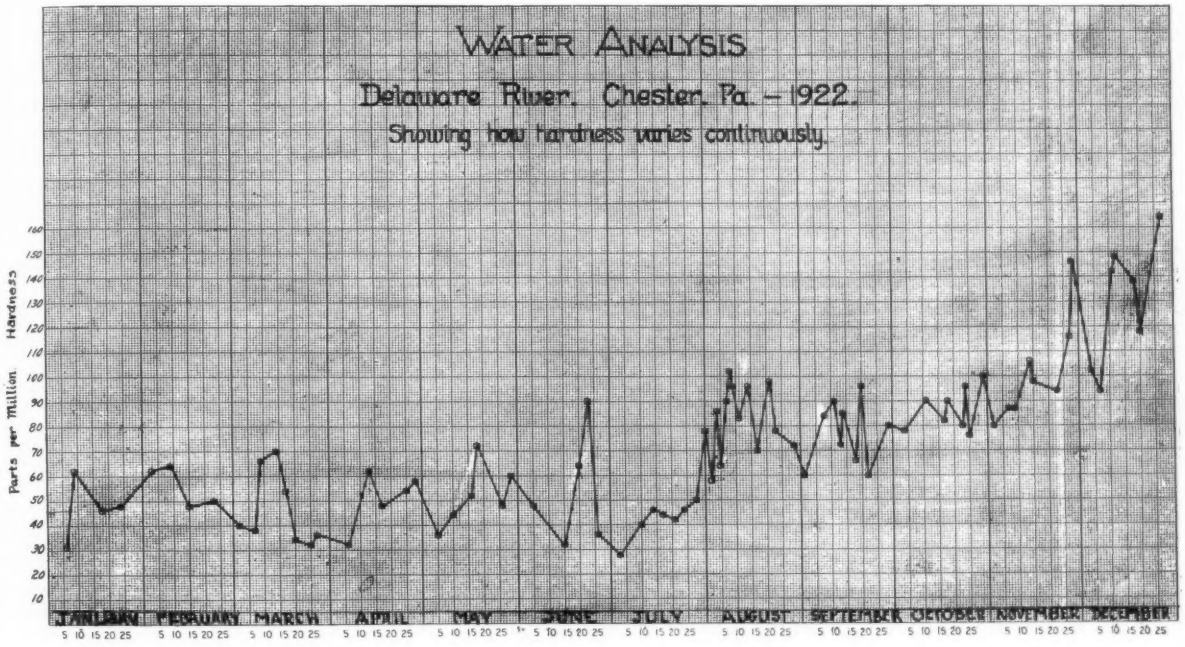
WATER ANALYSIS
Delaware River. Chester, Pa. – 1922.
Showing how hardness varies continuously.
Parts per Million Hardness
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FIG. 8

One of the principal features of the zeolite softener is that it produces a uniform water of zero hardness irrespective of the hardness of the raw water. Such typical variations as that in the hardness of the Delaware River supply show why unexplainable mysteries frequently arise in the textile mill where unsoftened water is used.

[*Slide: Fig. 8.*] This is a simple graph of the hardness of Delaware River water taken down at Chester, Pa. The months are represented along the abscissa and the ordinates represent the hardness. As you see, the hardness of that supply runs from 30 up to 160 parts per million expressed as calcium carbonate.

You can well imagine what happens to the scouring formulae and the dyeing formulae in a mill when the hardness of this water supply, which forms these insoluble compounds, is varying as erratically as illustrated there. Of course, with the zeolite softener that hardness is completely removed, so that the effluent is absolutely uniform in composition irrespective of the hardness of the raw water entering the softener. As long as the capacity of the softener in total number of grains has not been exceeded, the water coming out is absolutely soft.

Quality of Water in Textile Processing

Here are a few process diagrams which I have made up to illustrate the various processes in the branches of the textile industry; you will note that there is a double line around these processes where water is used; that is, the wet processes.

Referring to the cotton diagram (Fig. 9), the first wet process is keir boiling, where it is absolutely essential to have a water that is clear and free from hardness, because the cotton packed in the keir itself acts as an excellent filtering medium for any suspended matter which may be present in the water supply. Any hardness present will form insoluble soaps in suspension and these will be filtered out by the cotton pack as the liquors circulate through there, so that when the cotton is taken out of the keir there may actually be a layer of these suspensions on the surface and it is usually found that the cotton which is the worst is that on the top and near the sides of the keir.

Of course, even in keir boiling with caustic soda alone you form these insoluble soaps where there is hardness present, because in those pectins which constitute the wax on the cotton there are also fatty acids, and these fatty acids react with the caustic soda to form soaps; that is, the sodium compounds of the fatty acids are the soluble soaps, and these soluble soaps react with the lime and magnesia present to form the insoluble soaps. So the keir boiling, which is the foundation for good work in the rest of the cotton mill, is one of the most important steps in the manufacture, where it is necessary to use absolutely clear soft water.

In the mercerizing, which is the next process in which the water is used, it is not absolutely essential to have a soft water throughout; for the caustic immer-

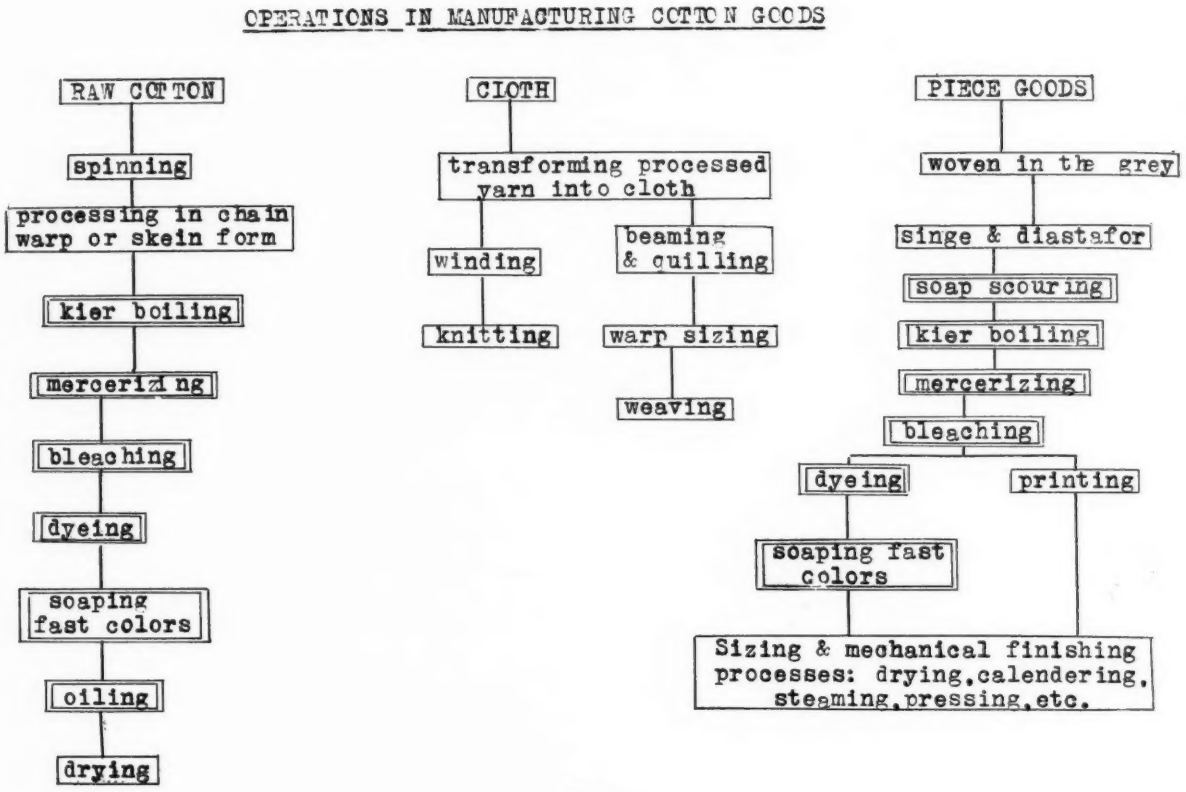

FIG. 9

sion, I believe that a soft water is of great advantage, because if there is any hardness present you may get some insoluble deposits on the surface of the yarn. If there are such deposits it prevents an absolutely even penetration of the caustic liquors. That means that the yarn or cloth is not evenly mercerized, and that in turn means that the dyestuff will not be evenly absorbed when that yarn or cloth is later dyed.

I know of actual cases where streaky dyeing in mercerized yarns and cloths has been eliminated by removing the hardness from the water used for the caustic immersions and for the rinses immediately following.

In the bleaching—that is, the application of the chemic, which is usually an alkaline solution of sodium hypochlorite—there is again danger of precipitations on the yarn, and it is advisable in the bleaching process to use water that is clear and free from hardness.

In the dyeing process in cotton, many of the dyes, particularly the substantive or direct colors, and the Indanthrenes and some of the other vat colors, form insoluble compounds with the lime and magnesia salts, and it is therefore essential to have the water absolutely free from hardness for those processes. Furthermore, in those classes of dyestuffs which form these insoluble compounds with the lime and magnesia salts, great economies are experienced by removing even the small amounts of hardness from the water. That is of particular advantage in dyeing absolutely fast colors with the Indanthrenes, because some of these dyestuffs are very expensive. Similarly, these fast colors are usually soaped after dyeing, and for that soaping work, as usual, it becomes necessary to avoid hardness.

In processing in cloth form the same facts prevail for the soap scouring, keir boiling, mercerizing, bleaching, dyeing and soaping as those described for yarns above.

[*Slide: Fig. 10.*] This is a process diagram of a woolen mill. Here we have what appears to be more mechanical steps in the manufacture, but at those points at which the water is used it is absolutely essential to have a water that is free from hardness. Take the scouring of the raw stock: I can't think of any other point in the textile industry where it is of more importance to have a clear soft water, because there you have a hot alkaline soap solution and the woolen fiber itself has that fir cone structure. We all know that in hot solutions precipitation takes place much more rapidly and more completely, and these

deposits are caught in the woolen fiber and are held fast. That, of course, means that we are going to have those deposits to interfere with all the future processes, aside from the fact that tremendous quantities of soap and soda are wasted here.

With the basic dyestuffs it is absolutely essential to have soft water, because the basic dyestuffs as a class combine with calcium and magnesium to form insoluble compounds and the economies that result from the use of soft water here are great.

Carding and spinning are merely mechanical processes, but these mechanical processes in wool show up very strongly the effects of either bad or good scouring. Often if you have a wool which is scoured in hard water you will find that the little teeth in the cards become clogged from collecting the soap deposits that were on the surface of the fibers.

In the finishing plant the processes involved are the same as those discussed above for stock and yarn scouring and dyeing.

[*Slide: Fig. 11.*] In the silk soaking before the reeling, it is a known fact that if any calcium or magnesium is present the silk fiber absorbs it and that hardness makes the fibers brittle so that they break in the reeling. The same applies to the soap and oil soaking which precedes the throwing, except that here you also have the opportunity of forming those insoluble soaps, and that prevents the fiber running smoothly when the silk is thrown and increases the breakage tremendously.

In skein processing, the degumming for the removal of the sericin from the silk, is carried out by immersing the silk in a soapy solution at the boiling point for anywhere from thirty minutes to a few hours, depending upon how far the degumming is to be carried and the quality of the goods being degummed.

Where hard water is used attempts are made to soften the water in the degumming vat by the use of soda ash in connection with the soap. Of course, that sort of treatment in the vat is usually carried out very empirically. A man throws in so much soda ash, and he may add not quite enough, or he may add too much. Frequently he adds too much and the result of having free alkali in the silk degumming bath at boiling temperature is disastrous. As you know, the silk is affected by alkalis, and the luster is deadened, the fiber becomes more brittle, the feel is spoiled and the color is made yellowish.

Where you have water absolutely free from hardness, it is unnecessary to use anything else in the degumming process except the pure olive oil soap in the water; the gum is removed and the fiber resulting therefrom is soft and clean.

In tin weighting, the actual weighting solutions themselves—that is, the stannic chloride which is applied to the silk—do not cause any precipitation because the stan-

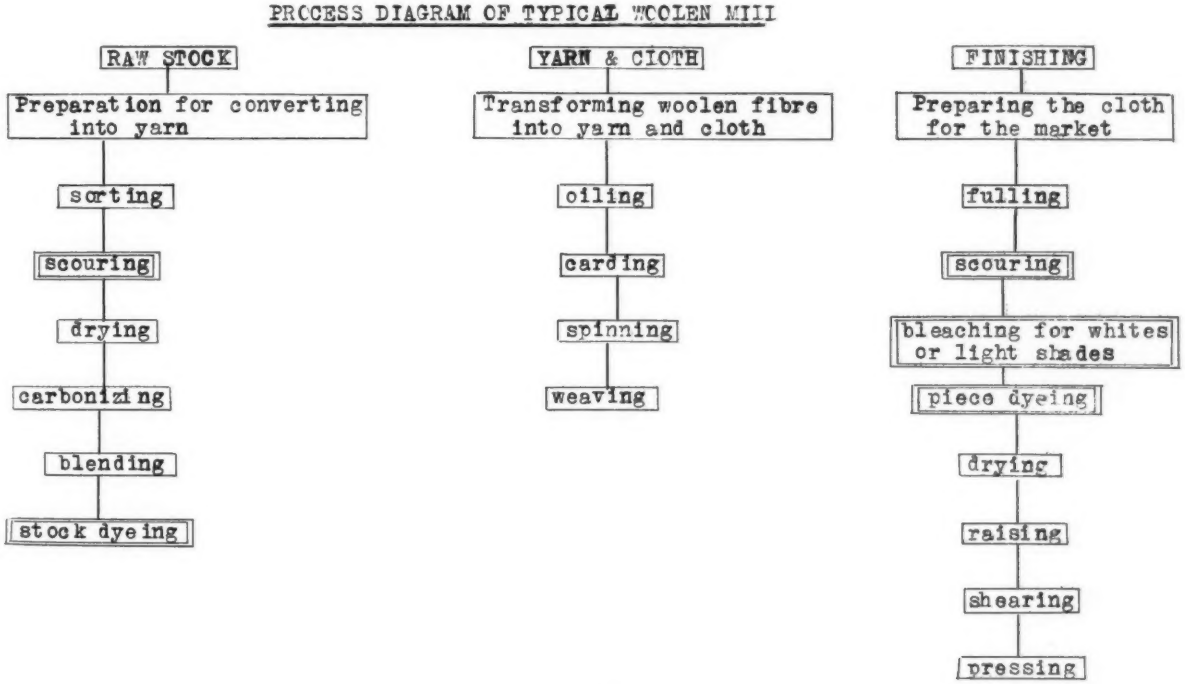

FIG. 10

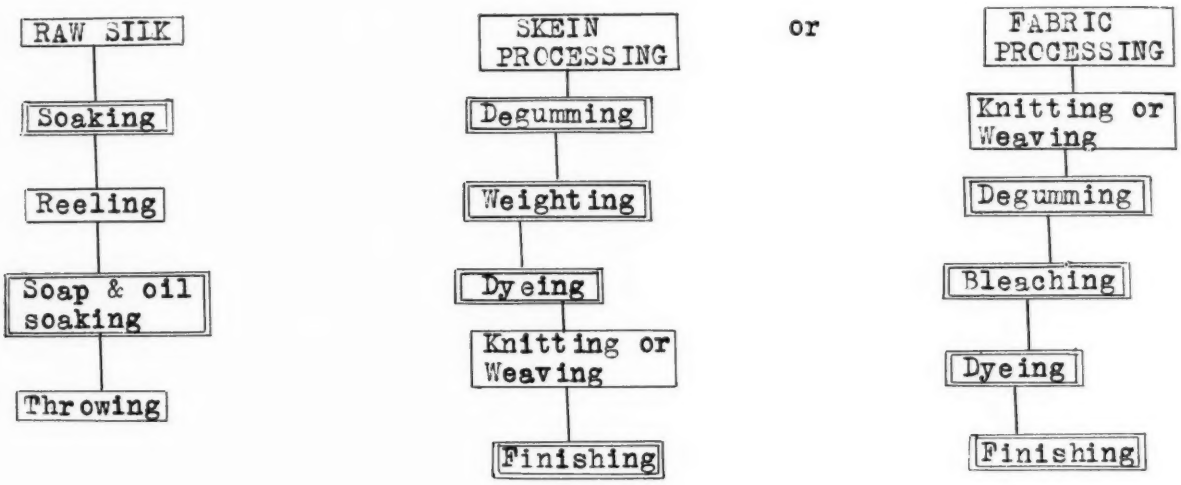

FIG. 11

nic chloride is an acid solution, but if the silk coming from the degumming bath has these precipitates all over it you will not get an even absorption of the tin salts, and as a result of that the tin will not be fixed evenly throughout the fiber. Then, when the skeins are dyed, the portions of the fiber which were not penetrated with the tin will not take that dyestuff as readily as those portions which have the advantage of the mordanting effect of the tin, and as a result of that you will have what are frequently referred to as "hungry spots" in the dyed silk goods; that is, the spots which have not taken the dyestuff as well as those parts that had the tin in them.

In the phosphate washes after the tin is applied it is again necessary to use a soft water because sodium phosphate will precipitate the insoluble phosphates of lime and magnesia.

It is clear that in each branch of the industry water is used in fundamental processes which affect practically all of the subsequent processes in the manufacture.

There is a great amount of specific data available illustrating the advantages and economies of using absolutely clear soft water in the textile mill even where the untreated supply is comparatively soft. It should be borne in mind that the cost of installing and operating the zeolite softener is practically in proportion to the hardness of the water being treated, and therefore the economies effected show excellent returns on the investment for comparatively soft waters as well as for the harder supplies. None of the specific data showing these actual economies in practice has been presented this evening because practically all this information is of an empirical nature and is only of interest as it can be borne out by the facts and figures available in mills where such systems are in operation. The reliable manufacturers of water purification apparatus are always ready to place these facts and figures at the disposal of any who care to investigate them, and the great numbers which have been satisfied with the results of such investigations is proven by the continuously increasing number of modern water purification plants installed for textile purposes. [Applause.]

Chairman Grandage—Mr. Tiger stands ready to answer any questions that you put to him, but if I can ask your indulgence for just a few minutes I would like to have Carleton C. Adams, of the Rockland Finishing Company, present for us, if he will, his problem of soft and hard water from the cotton manufacturer's standpoint. If we can have Mr. Adams and Mr. Culver present what they have to say on this subject, then when they get through we can go right to the informal discussion.

(The papers presented by Mr. Adams and Mr. Culver will appear in the next issue of the Proceedings.)

Chairman Grandage—It is getting late but I think there are some of us that want to ask Mr. Tiger and possibly Mr. Culver and Mr. Adams some questions. I notice that the Secretary has written in here, "It is hoped that a very general discussion of the subject will follow the remarks of the speakers."

I know of several men that want to know something about this, and I wish they would get busy and ask Mr. Tiger the questions that they want to know the answers to.

Mr. Culver—I would like to ask Mr. Tiger, Mr. Chairman, if it is true that permutized water has an unusually marked effect on boiler tubes and plates in the way of pitting. I have heard it said that permutized water did have such an effect.

Mr. Tiger—I think when we discussed the subject of dissolved gases in water, I mentioned that the prime cause of corrosion (and that includes also pitting) is the oxygen dissolved in the water. If you drive the oxygen completely out of the water, as you can do in the ordinary open heater by heating the water to the boiling point, then the water entering the boiler will not cause any pitting or corrosion.

You can prove that most readily (and you can answer directly this question about the zeolite softened water causing pitting) by taking a sample of a hard water, passing that very hard water through zeolite and removing all the hardness. Then take the sample of the softened water and just boil it in an open vessel and carefully siphon it from that open vessel into a bottle in which you have some wire nails, and be certain that the bottle is filled, and that you do not admit any air during the transference of the water. Then stopper the bottle up and seal it up and compare the result on those nails with similar nails put in a similar bottle in either the raw or the unboiled permutized water. You will find that the average surface water, whether it be the softened or unsoftened water, will cause the nails to rust, whereas that same water boiled, whether it is the permutized or unsoftened water, will not cause the nails to rust at all.

I think that simple demonstration is the best proof that the thing which causes the corrosion is the oxygen in solution, and if you drive that off completely, as you can do in the simple open heater, you certainly will not get any corrosion or pitting in the boiler.

That, of course, is also borne out by the tremendous number of power plants, power plants operating the largest boiler units in the country, using the zeolite softened water at the present time, who have been using it for years, and who have been continuing to increase their plants on the zeolite softened water.

Does that answer your question?

Mr. Culver—That is a very good answer for that, for cold water, but water which has been previously softened and pumped, we will say, through the economizers, and which has been recovered and kept at a certain elevated temperature, would the high temperature have any added effect on the softening action of the dissolved oxygen on iron?

Mr. Tiger—I didn't quite understand your question. You say it is pumped through the economizer. Now, before your water enters the economizer it is passed through the open heater.

Mr. Culver—I mean after it has been softened, preheated, it passes through the economizer at an elevated temperature constantly. Would that not have some effect on the economizer, for instance?

Mr. Tiger—The water usually enters the economizer after it leaves the boiler feed water heater.

Therefore, by that time you will have removed the gases, and the water is free from the oxygen and therefore doesn't affect your economizer any more than it does your boiler tube. But the point is, as I stated before, if that water contains oxygen, whether hard or soft water, it will affect the metal and will pit and corrode it, and if the oxygen is out, similarly, whether it is hard or soft water, it will not affect the metal.

Does that cover it?

Mr. Culver—Yes.

Mr. Stott—May I ask Mr. Tiger if zeolite is a patented product?

Mr. Tiger—Do you mean the mineral?

Mr. Stott—Yes.

Mr. Tiger—There are some processes in connection with the manufacture of the mineral. I mentioned before that there were several types of minerals, and some of these zeolites are manufactured in a furnace by fusing various chemicals and the mineral is poured from this furnace similar to glass. This glass is later crushed and graded, and there are certain process patents on that type of manufacture. Similarly, there are certain process patents on zeolite produced by the precipitation process. There are also process patents on zeolites which are dug from the earth and which are then treated. That type of zeolite is the non-porous class that I spoke of before, but the other patents which I think you may be referring to are the use of zeolites for softening water—is that what you mean?

Mr. Stott—No, what I really wanted to know was about the chemical constitution of the zeolite itself, and where samples of this zeolite material could be obtained.

Mr. Tiger—It could be obtained from any manufacturer, I believe. I won't speak for the others, but they can be obtained from us, I know.

Mr. Stott—I am just interested enough to see if it will have any effect on some trouble we have been having, in helping the solubility of certain dyestuffs by treating water.

Mr. Tiger—Is it a test which you could carry out on a small scale? I have found from experience that frequently you can't observe the thing on a very small scale. You have to get it on a large scale.

Mr. Stott—This is distinct enough that it would show even if tried on a very small scale if the zeolite had any effect on it.

Mr. Tiger—Well, we would be pleased to give anybody a sample of the material to try it out if they want to do that.

Mr. Howes—Mr. Tiger, you didn't refer to-night at all to the question of economy of soap or other chemicals that might be used. Am I right in believing that there is a very material saving effected by perfectly soft water?

Mr. Tiger—Yes. That is what I stated at the end of my talk. The reason I didn't refer to that was because if I gave you any figure of comparison like that at random it might appear somewhat exaggerated. For example, if I told you that in a certain worsted cloth manufacturing plant that had been operating on Delaware River water, which runs as you saw from the chart, anywhere from about fifty to one hundred fifty parts per million and it averages only around sixty parts per million which corresponds to four grains per gallon—if I just gave you a figure and told you that the saving in soap in that mill was 68 per cent, it would sound a little bit exaggerated—and the saving in soda in the same plant was about 70 per cent. It is a plant weaving and finishing worsteds

That is why I said that these figures are just simply empirical and their don't bear any weight unless you can actually produce the plants where those things have taken place. That gives you an idea of about the size of the savings that can be effected in the scouring of cloths or woolen products.

Chairman Grandage—Does anybody else wish to ask Mr. Tiger a question? If not, may I ask that we give Mr. Tiger and our other speakers of the evening a rising vote of thanks for the most excellent papers presented here this evening?

. . . It was regularly moved and seconded that the speakers of the evening be extended a vote of thanks. The motion was unanimously carried by a rising vote. . . . [Applause.]

. . . The meeting adjourned at ten fifteen. . . .

TWENTY-FIFTH COUNCIL MEETING

The Twenty-fifth Council Meeting of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., on September 26, 1924. The following members were in attendance: L. A. Olney, William K. Robbins, William H. Cady, W. C. Durfee, G. A. Moran, A. E. Hirst, W. M. Scott, W. R. Moorhouse, J. F. Bannan and W. E. Hadley.

In view of the cordial acceptance accorded the 1923 and 1924 Year Books of the Association, the Council voted to publish another in 1925 and to ask the Howes Publishing Company to co-operate with them as heretofore.

The Council expressed their appreciation for the very satisfactory manner in which the Howes Publishing Company have handled the publishing of the 1923 and 1924 Year Books, and such appreciation will be spread upon the records of the Secretary.

Following receipt of a letter from the Chemical Equipment Association regarding the meeting which is to be held in Providence, R. I., the Council voted to recommend that the Rhode Island Section and the Northern New England Section hold a joint meeting in Providence during the week of June 22-27, 1925, and extend a general invitation to any members of the Association who may be able to attend this session.

The matter of the coming Annual Meeting, which is to be held in Philadelphia on December 5 and 6, was gone into in detail and considerable progress was made in outlining the program for the morning and afternoon sessions. A letter from Dr. C. S. Hollander, Chairman of the Philadelphia Local Section, indicated that they have the matter well in hand and an interesting session is assured.

In accordance with a request received from the American Engineering Standards Committee, the President of the Association will serve as a member of this committee to represent our organization.

A general movement has recently taken place throughout the Southern States, the object of which has been the formation of a Southern Section of the Association.

In accordance with Article 13 of the Constitution, the following members have requested the approval of the Council for the formation of such a Southern Section: H. M. Chase, A. C. Burkart, C. A. Schier, E. W. Sweet, A. W. Mungall, G. F. Luck, R. B. Smith, C. L. Dunn, H. W. Ormand, H. S. Siever, C. H. Stone, G. H. Dubois, N. T. Johnson, J. H. Carey, H. S. Busby, W. D. Shields, C. S. Doggett, W. D. Appel, V. D. Le Portier, E. F. Bower, A. P. Shirley, Ruth O'Brien, J. B. Smith, P. F. O'Neill, M. R. Vieira, H. J. Horne, G. I. Purvis, J. Stott, Jr., J. S. Oates, B. R. Dabbs and L. S. Little.

The Council approved of such a section and appointed Dr. E. H. Killheffer, secretary pro tem., who will call a meeting of the Southern members during the week of the Textile Exposition to be held at Greenville, S. C.

The geographical boundaries of the proposed Southern Section will be all territory south of the Potomac River and east of the Mississippi River.

The following applicants were elected to membership:

Active

Alston, John, 126 Trenton Street, Lawrence, Mass. Superintendent, Farwell Bleachery.

Benedix, August F., Box 107, Ipswich, Mass. Dyer, Ipswich Mills Company.

Branegan, James A., 1410 North Front Street, Philadelphia, Pa. Chemical manufacturer; president Kali Manufacturing Company.

Church, Kenneth B., 257 Washington Street, Norwich, Conn. Chemist, Aspinook Company, Jewett City, Conn.

Davenport, S. G., 1410 North Front Street, Philadelphia, Pa. Chemical manufacturer; secretary and treasurer Kali Manufacturing Company.

Hirsch, Louis S., 15 William Street, New York, N. Y. Manager B. P. Ducas Company.

Kidd, Thomas S., Box 361, Passaic, N. J. Dyer, Passaic Piece Dye Works.

Ormand, Harry W., Union Bleachery, Box 598, Greenville, S. C. Dyer.

Rittger, Albert R., 19 Clark Street, Glen Ridge, N. J. Salesman and demonstrator, A. Klipstein & Co., New York, N. Y.

Stead, Mitchell, 5322 North Carlisle Street, Philadelphia, Pa. Chemist and dyer, Folwell Bros.

Wall, Eugene W., 310 Rosemore Avenue, Glenside, Pa. Chemist, Kali Manufacturing Company, Philadelphia, Pa.

Williams, Charles, 14 Pine Street, Adams, Mass. Dyer, Renfrew Manufacturing Company.

Junior

Dickerson, William G., Consolidated Piece Dye Works, Paterson, N. J. Chemist.

Palmer, Ray E., 12 Kossuth Street, Pawtucket, R. I. Chemist, Atlantic Mills, Providence, R. I.

Schmaltzler, Karl B., National Aniline & Chemical Company, Boston, Mass. Assistant dyer.

Sweet, George Albert 2nd, 98 Prospect Street, Pawtucket, R. I. Textile apprentice, U. S. Finishing Company.

W. E. Hadley, Secretary.

TWENTY-THIRD RESEARCH COMMITTEE MEETING

The twenty-third meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held on September 26, 1924, at the Engineers' Club, Boston, Mass. The following members were in attendance: L. A. Olney, William K. Robbins, William H. Cady, W. C. Durfee, G. A. Moran, A. E. Hirst, W. M. Scott, W. R. Moorhouse, J. F. Bannan, E. H. Killheffer, H. Christison, H. W. Leitch, W. D. Appel, W. J. Murray, P. J. Wood and W. E. Hadley.

Dr. W. M. Scott, Chairman of the Sub-Committee on Silk, consisting of himself, P. J. Wood and Ed. F. L. Lotte, presented a revised report covering alterations in the fastness tests as applied to the washing of silk material. The report appears in full in this issue.

W. D. Appel pointed out in considerable detail changes which he felt should be considered as a basis for the revision of the present tentative fastness reports which have appeared in the Year Book. It was decided that Mr. Appel should make fastness tests in his laboratory, with the object of proving or disproving the value of certain of the fastness tests which have been suggested, and he will report back to the committee regarding the results of his tests.

W. E. Hadley, Secretary.

REPORT OF MEETING OF SUB-COMMITTEE ON SILK

Held in Paterson, N. J., September 16, 1924

In accordance with the request made by President L. A. Olney in his letter of September 4, 1924, this committee discussed a program for the Research Committee for the coming year. In this connection we wish to emphasize the following points:

1. The preliminary report of the Sub-Committee on Light practically eliminates all methods of standardizing light exposure with the exception of the use of some standard unit.

2. The establishment of such standards is the most important work before the Research Committee at the present time, and should be hastened as much as possible.

3. We believe that the problem of finding standards is a separate one for cotton, wool and silk, and could best be handled by sub-committees for each fiber, as in the case of washing. We therefore recommend the appointment of such sub-committees for this specific purpose.

4. We also believe that the Association should continue the work on classification of dyestuffs with respect to washing in accordance with the specifications published in the 1924 Year Book. The Sub-Committee on Silk has started this classification, as evidenced by the table submitted at this meeting, but is unable to carry it on any further owing to the amount of work involved. We offer two plans for the discussion of the Research Committee: (1) That the Association undertake to provide funds for the hire of some person to do the routine testing which is necessary, under the general supervision of the Research Committee; or (2) that an attempt be made to interest the various dyestuff manufacturers in testing their dyestuffs in their own laboratories according to the standard methods proposed in the 1924 Year Book, and furnishing the results to the Research Committee for publication in our proceedings.

GROUP S-I: FASTNESS TO WASHING OF DYESTUFFS ON SILK

DYESTUFF						Fastness with Respect to Staining of White		
Name and Maker	Color Index No.	Schultz No.	Method of Dyeing	Strength of Dyeing (%)	Color Change	Cotton	Wool	Silk
Ciba Blue 2B Powder—(SCI)	1184	881	1924 Year Book—Group S-I, Class I	5	1	1	1	1
Sulphogene Indigo Blue G—(DuP)	None	None	Similar to Class I above	5	1	1	1	1
Erio Chrome Azurole B—(Gy)	720	551	Acetic acid—top chrome	5	2	2	2	2
Primuline (see 1924 Year Book)	812	616	Dyed with acetic and Glauber salt. Develop beta naphthol	10	1	2	2	2
Diazine Black V—(NAC)	None	None	Group S-I, Class II	10	2	2	2	2
Victoria Blue B (see 1924 Year Book)	729	559	With acetic acid	1	3	3	3	4
Brilliant Green (see 1924 Year Book)	662	499	With acetic acid	1	4	5	5	5
Wool Violet 4BN—(NAC)	698	530	Group S-I, Class III	2	3	4	3	4
Patent Blue A—(S)	714	545	Group S-I, Class IV	2	4	4	4	4
Erie Green MT—(NAC)	593	474	Acetic acid and Glauber salt	2	3	1	1	5
Chrysophenine—(GCC)	365	304	Acetic acid and Glauber salt	2	3	2	2	5
Erie Fast Orange A—(NAC)	326	279	Acetic acid and Glauber salt	2	3	3	1	5
Fast Red A (see 1924 Year Book)	176	161	Similar to Class IV above	2	4	5	5	5
Patent Blue V—(S)	712	543	Group S-I, Class V	2	5	5	5	5
Alizarine Sapphire—(NAC)	1054	858	Similar to Class V above	2	5	5	5	5
Orange II—(DuP)	151	145	Similar to Class V above	2	5	5	5	5

[Note—The Color Index abbreviations for the makers are used.]

Respectfully submitted by the Sub-Committee on Silk.

WALTER M. SCOTT, Chairman.
P. J. WOOD.
EDW. F. L. LOTTE.

Supplementary Report

Fastness Tests for Dyed Silk

1. We recommend that the following changes be made under Group S-I, Method of Test on Skeins:

(a) Change the first sentence to read: "Take about a 5-inch length of the dyed silk skein, divide it in three parts, and add to each part an equal amount of undyed silk, wool, and cotton, respectively, then weave into a braid for one-half of the length of the fibers, leaving the other half open."

(b) Change the sixth sentence to read: "At the end rinse the braid in cold water, extract, and dry in the air. The braid should be dry within a period of ten minutes after it leaves the extractor."

(c) Change the eighth sentence to read: "It is best to judge the closed portion of the braid for staining of adjacent fibers, and the open portion for alteration in color."

2. In order to make a start on the classification of dyestuffs on silk with respect to washing by the standard method which is proposed in the 1924 Year Book of the Association, we submit the attached table, which has been compiled from experiments carried out under the direction of your sub-committee and approved by them in conference. We recommend that this table be published in the proceedings of the Association.

Respectfully submitted by the Sub-Committee on Silk.

WALTER M. SCOTT, Chairman.
P. J. WOOD.
EDW. F. L. LOTTE.

FIRST FALL MEETING OF NORTHERN NEW ENGLAND SECTION

The first meeting of the Northern New England Section for the season 1924-25 will be held at the Lowell Textile School, Lowell, Mass., on Saturday, October 25, 1924.

Harry R. Davies will speak on the Celanese colors and their application to artificial silk. Mr. Davies has been making a special study of the application of these colors, and undoubtedly has much of interest to present.

Dr. H. C. Chapin will demonstrate apparatus for electrical titration of solutions, and determination of hydrogen ion concentrations.

The members of the Section and their guests are cordially invited to inspect the school buildings and the equipment during the afternoon. Dinner will be served by the Page Catering Company at 5.30 in the main auditorium of the school, for which a charge of $2 will be made. It is very necessary for this dinner that reservations be with the Secretary by October 22, 1924. The caterer will be entirely unable to accommodate more than the number specified to him three days before the meeting. Will you not give this mat-

ter your prompt attention by returning the enclosed card? Members from other Sections are cordially invited to attend.

A. K. JOHNSON, Secretary.

APPLICANTS FOR MEMBERSHIP

Active

Arrington, Richard W., superintendent Union Bleachery, Greenville, S. C. Sponsors: A. H. Pierce and C. H. Stone.

Burkart, Alf. C., textile chemist and dyestuff jobber, Burkart, Schier Chemical Company, Chattanooga, Tenn. Sponsors: Charles H. Stone and J. B. Smith.

Collins, John J., salesman and demonstrator, Kalle Color & Chemical Company, Boston, Mass. Sponsors: J. F. Bannan and S. P. Kenny.

Dunn, C. L., dyer and superintendent reworked wool, 115 Market Street, Chattanooga, Tenn. Sponsors: P. F. O'Neill and B. R. Dabbs.

Howard, Frank E., divisional superintendent, Pacific Mills, Wellford, S. C. Sponsors: Leonard S. Little and J. J. Sokolinski.

Jorgensen, Axel Julius, superintending chemist, Bibb Manufacturing Company, Macon, Ga. Sponsors: C. H. Stone and H. M. Chase.

Lavoie, Philip, superintendent of finishing, Mount Hope Finishing Company, North Dighton, Mass. Sponsors: W. S. Williams and Charles R. Ewing.

Mahon, Brown, vice-president and assistant treasurer, Judson Mills, Greenville, S. C. Sponsors: M. T. Johnson and E. H. Killheffer.

McMann, Walter C., superintendent bleaching and finishing, Riverside & Dan River Cotton Mills, Danville, Va. Sponsors: H. M. Chase and J. W. Estlow.

Millikin, Joseph P., chemist, Bellman Brook Bleachery Company, Fairview, N. J. Sponsors: F. L. Bume and George O. Bryant.

Mungall, A. W., dyer, Massachusetts Cotton Mills, Lindale, Ga. Sponsors: P. F. O'Neill and J. Baynard Smith.

Mungall, T., dyer and bleacher, Pell City Mills, Pell City, Ala. Sponsors: P. F. O'Neill and B. Smith.

Oesterreich, I. E., dyer, United Hosiery Mills, Chattanooga, Tenn. Sponsors: P. F. O'Neill and J. B. Smith.

Rollins, Henry E., colorist, Grasselli Dyestuff Corporation, 117 Hudson Street, New York, N. Y. Sponsors: C. A. Seibert and B. Borrmann.

Schier, C. A., chemical and dyestuff jobber, Burkart, Schier Chemical Company, Chattanooga, Tenn. Sponsors: Charles H. Stone and J. B. Smith.

Steiner, George, boss dyer, Princeton Worsted Mills, Inc., Trenton, N. J. Sponsors: B. K. Archer and J. H. Hennessey.

Stewart, William W., yarn dyer, Franklin Process Company, Fall River, Mass. Sponsors: L. A. Olney and R. F. Culver.

Stott, Philip H., chemist, Newport Chemical Works, Inc., Passaic, N. J. Sponsors: J. S. Unterweiser and Charles F. Schaumann.

St. John, Sylvester, bleacher, Rockland Finishing Company, Garnerville, N. Y. Sponsors: C. C. Adams and George A. Northup, Jr.

Sweet, E. W., salesman-demonstrator, Grasselli Chemical Company, Burlington, N. C. Sponsors: Charles H. Stone and H. M. Chase.

Tillson, Henry E., salesman and demonstrator, Kuttroff, Pickhardt & Co., Philadelphia, Pa. Sponsors: J. H. Hennessey and B. K. Archer.

White, Noel D., dyer, Davenport Hosiery Mills. Sponsors: P. F. O'Neill and J. B. Smith.

White, Thomas E., boss dyer, Brogon Mills, Anderson, S. C. Sponsors: J. H. Carey and C. H. Stone.

Junior

Barker, W. L., chemist, Riverside & Dan River Cotton Mills, Danville, Va. Sponsors: H. M. Chase and J. W. Estlow.

Durgin, William E., student, Lowell Textile School, Lowell, Mass. Sponsors: L. A. Olney and A. K. Johnson.

Leftwich, Ernest H., second hand, Union Bleachery, dye room, Greenville, S. C. Sponsors: A. H. Pierce and C. H. Stone.

Shirley, Archie P., second hand, Southern Worsted Corporation, Greenville, S. C. Sponsors: C. H. Stone and H. M. Chase.

Watt, James A., color dyer, Loudon, Tenn. Sponsors: G. F. Luck and J. J. Sokolinski.

Wright, Elmer P., bleach-house assistant, Pacific Mills, Wellford, S. C. Sponsors: Leonard S. Little and J. J. Sokolinski.

CORRECTION

In printing the Report of the Committee on Fastness to Light in the 1924 Year Book the word *June* was unfortunately omitted in next to the last paragraph on page 74, where reference is made to relative power of fading lamps and sunlight. Without specification of the time of year used for comparison the statement has little or no value. The paragraph referred to should read as follows:

"So many different elements enter the relative fading power of sunlight as compared with the artificial lights mentioned above that it is difficult to establish a ratio which is at all absolute. However, it may be said that five days of New England June sunlight is approximately equivalent to forty hours of the Fade-ometer."

CHANGES OF ADDRESS

Bailey, Sydney, care of Bick Dyeing Company, Reading, Pa.

Baird, William D., 1075 Longfellow Avenue, Bronx, N. Y.

Blaeser, Paul R., 405 Knickerbocker Avenue, Paterson, N. J.

Chantler, Ambrose R., North Scituate, R. I.

Donovan, Joseph R., 22 Romsey Street, Dorchester, Mass.

Flynn, Thomas P., 65 Wheeler Avenue, Edgewood, R. I.

Goldthwait, Charles F., 358 Lordship Manor, Stratford, Conn.

Graenicher, Otto F., 335 Highwood Avenue, Glen Rock, N. J.

Horne, Hugh J., Box 11, Pomona Mills, N. C.

Houth, Joseph, Jr., Cowesett, R. I.

Jefferies, William H., Palmer House, 181 Main Street, East Orange, N. J.

Lilley, S. Clark, 63 Howe Street, New Haven, Conn.

Livermore, William D., American Woolen Company, Administration Building, Shawsheen Village, Andover, Mass.

Mackenzie, Kenneth, Box 51, State College Station, Raleigh, N. C.

McCullough, Hector A., 36 Elro Street, South Manchester, Conn.

Vieica, Nicholas, Rent Apt., Converse Street, Spartanburg, S. C.

Morrison, Alexander, American Woolen Company, Administration Building, Shawsheen Village, Andover, Mass.

Palizza, Louis, 4 Division Street, Stamford, Conn.

Remlein, R. L., 8 Thomas Street, New York City.

Travers, Joseph E., 110 High Street, care of United Aniline Company, Boston, Mass.

Sittig, A. E., 29 Pleasant Avenue, Union Hill, N. J.

Wang, Chen, 105 Oxford Place, Ithaca, N. Y.

Worthen, C. T., 508 Cottage Place, Utica, N. Y.

ASSOCIATION BADGES

Those who attended the Annual Meeting at Providence had an opportunity to examine and purchase the new lapel button badges which were there distributed by the Secretary.

For the benefit of members who were unable to attend the meeting an illustration of the badge is shown herewith.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

WALTER E. HADLEY,
5 Mountain Avenue,
Maplewood, N. J.

MEN OF MARK IN THE DYESTUFF FIELD

HARRY R. DAVIES

Vice-President

Dyestuffs Corporation of America

HARRY R. DAVIES is a native of Manchester, England, and was educated at the Manchester Grammar School and the Municipal College of Technology in that city, where he took the Chemistry and Dyeing course under Professor E. Knecht and was Silver Medalist in Cotton Dyeing, Ordinary and Honors, in two successive years.

After graduation in 1897 he entered the employ of Levinstein, Ltd., working in the dyeing laboratory, which was then under the direction of Julius Huebner. From 1900 to 1901 he was a demonstrator at the evening class in dyeing and calico printing at the Salford Technical School with J. R. Appleyard.

In 1902 he came to America to assume charge of the laboratories of Thomas Leyland & Co., who had been appointed United States agents for Leyenstein, Ltd. Upon the formation of I. Levenstein & Co. in 1905 he became chief chemist for this concern, which position he occupied until he was appointed a director in 1915.

Early in the current year the Dyestuffs Corporation of America was formed to distribute, in America, the products of the British Dyestuffs Corporation and to succeed to the business of I. Levenstein & Co. Mr. Davies was elected vice-president and treasurer of the new concern, which offices he now holds. Hence, his entire business life has been spent in the service of Levinstein, Ltd., its agents and successors.

Mr. Davies is also president of the Drysalters' Club of Boston, one of the oldest and best known organizations of dyestuff men in the country. He is universally popular, and is held by his contemporaries to be one of the best informed men in America on questions related to the application of dyestuffs.

AMERICAN
DYESTUFF REPORTER
SAMPLE SWATCH QUARTERLY
Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.
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October 20, 1924

CO-OPERATION VS. COMPETITION

IT has recently been urged by several persons prominently identified with the industry that American dyestuff manufacturers should make every effort to produce at the earliest possible moment colors equivalent to those types which still remain upon the "non-competitive" list. There is no doubt that such action on their part is greatly to be desired, but if each of several leading manufacturers endeavors to stop the entire gap by himself it is obvious that tremendous duplication of effort will result.

In the recent past, American manufacturers seeking new products on which to concentrate their research and manufacturing efforts have apparently worked entirely independent of each other, and have, in many cases, seized almost simultaneously upon the same problems. The result of this course has been that several greatly needed but identical colors have been brought out within a few weeks of each other by two or more different manufacturers.

Thus the efforts of the various organizations have been largely fruitless, financially speaking, because no sooner did one produce a color which could be marketed at a profit than some competitor appeared offering a similar product, with the old story of price competition ensuing immediately thereupon, leaving in its wake nothing but deficits for all parties concerned.

To The REPORTER it appears that the time has now arrived when American manufacturers need worry less about foreign than domestic competition. There is to-day scarcely a color having a quantity market which is not produced by two or more manufacturers, the potential production of any one of whom would be sufficient to care for the entire requirements of the country. Each of these, in order to keep his plant busy and reduce overhead, strives vainly to secure the entire business on the product in question by the only means which he believes will attain his end—namely, continuous price reduction.

The folly of such a course as this is too obvious to require comment. There can, in a last analysis, be only one result—the survival of the fittest.

How much wiser and more profitable it would be for the parties concerned were it possible to substitute for this ridiculous overproduction and consequent price competition a disposition among the principal factors in the industry to give and take—allowing those best qualified to manufacture individual colors, and at the same time dropping from production schedules colors which are produced solely "to keep the plant running."

We have in these United States of America adequate laws designed to prevent combinations in restraint of trade, and it is not our wish or intent to advocate anything which might run counter to the statutes. We are firmly convinced, however, that American dyestuff manufacturers could, by free and open discussion of their problems, either directly or through some friendly intermediary, do much to eliminate the needless duplication of research and manufacturing effort which constitutes such a serious burden to the industry, and provides nothing of value either to the consumer of dyestuffs or to themselves.

ARE YOU A BALLOT-SLACKER?

SIXTEEN days from to-day we, as American citizens, are to select the man who is to be our leader during the next four years. As this day draws near the cry of "Get out the vote!" swells to a nation-wide, non-partisan appeal to every man and woman of voting age to go to the polls on November 4. This appeal now has become of unusual necessity. Those who are fighting for better government by the people realize the importance of preventing the choice of a President from being thrown into Congress. The uncertainty attendant upon such an outcome would probably break the steady upward curve of business and promote an undesirable spread of pessimism.

The independent party rests the weight of its hopes on that other "third party"—the vast multitude of non-voters. Its own fanatical supporters will rush to vote on Election Day 100 per cent strong. These supporters might be termed the "positive" strength of the party; but it is as nothing when compared with the "negative" strength which this party has back of it—the growing army of ballot-slackers.

By neglect of his duty as a citizen of these United States the non-voter has drawn to himself ridicule and shame. He is either lazy or indifferent; he lacks the enthusiasm which the Progressives have back of them. He ignores his obligation to uphold the principles for which his Revolutionary ancestors fought. He is the man who says, "Whether I vote or not doesn't matter."

Let him cast off his indifference this Election Day; let him join in a concerted effort to defeat the purpose of the independents to make the election undecisive; let him not give his "negative" support to their principles; let him help to elect his choice for President by coming out and voting, in the interests of better business, better citizenship and better government.

Indigoid Vat Colors Discharged with Hydrosulphite

By B. Wuth, Ph.D.

Through the introduction of soluble stable hydrosulphite compounds and their stabilization with formaldehyde, discharge printing of dyed grounds became a very important branch of textile printing, and the large number of substantive azo dyestuffs dischargeable with reducing agents facilitated and accelerated very materially the adoption of the hydrosulphite-formaldehyde-discharge method in practical work.

For light and medium shades direct dyed grounds were generally sufficiently fast; for darker shades, however, the coupled or developed colors were reverted to on account of their superior fastness.

Whereas the white discharge was quite a simple operation, the colored discharge offered difficulties, inasmuch as a very small number of dyestuffs withstand the reducing action of the hydrosulphite. There were but a small number of basic dyestuffs with which without doubt very beautiful and bright effects could be produced, but these are fugitive to light.

The ever-increasing call for faster discharge effects was met by the vat colors, which are being increasingly used for colored hydrosulphite discharge work; but whereas formerly the discharge ground was faster than the discharge effect, the direct colored ground is now inferior in regard to fastness to washing—though not to light if the Chlorantines are used—than the vat color discharge.

By the introduction of aromatic quatern ammonium bases into the hydrosulphite discharge it became possible to discharge the majority of the indigoid vat dyestuffs, and there is no reason to-day why the fastness of discharged goods should be in any way inferior to that of self-shade vat dyed piece goods. Almost any desired shade in any degree of fastness can to-day be produced with dischargeable vat dyestuffs.

Thanks to the existence of vat dyestuffs derived from aniline, naphthalene, anthracene and carbazol and to the different characteristics of their alkylated leuco compounds, it is possible by the correct choice of dyestuffs to produce vat colored discharge effects on vat colored dyed grounds and thus to obtain prints which in every respect possess the highest degree of fastness properties that science and industry can produce.

A folder enclosed in this issue—Hydrosulphite-Discharge on Ciba Colors—illustrates the manifold dischargeable vat colors in a white discharge. Colored discharge effects are obtained by adding non-dischargeable vat dyestuffs of the anthraquinone series to the white discharge printing color.

The process is short and economical, as the dyeing or padding of the ground is much more rapid than the dyeing of a developed direct dyestuff and the discharge is effected in the ager without subsequent steaming.

SIMPLIFIED METHOD FOR RESIST DYEING

The resist dyeing of yarns or raw stock is a lengthy and by no means simple operation and calls for the greatest care on the part of the dyer, if good results are to be obtained.

The old method of resist dyeing usually occupies a whole day, and necessitates the use of two baths, one for the dyeing and another for the resisting process. In the first bath, tannic acid is added to the dye solution and in the second, antimony salts and tin crystals.

Care must be given to the choice of dyestuffs; some colors are more adapted for the dyeing of yarns which are to be resisted while others are more suitable for dyeing pieces containing resist dyed yarns.

A simplified method for the resisting of yarns, and one which can be carried out in less than two hours is the following:

The yarn to be treated is entered into the dyeing machine which already contains the required amount of color, together with 10 per cent of tannic acid and from 5 to 8 per cent of acetic acid. The temperature of the bath is then slowly raised to 80 deg. Cent. and maintained at this temperature for thirty minutes, after which it is increased to 90 deg. Cent. and the dyeing continued for another thirty minutes. The bath is then cooled to 80 deg. Cent. when 3 per cent stannous chloride is added and the dyeing continued at this temperature for a further thirty minutes. The material is then well washed to remove all traces of stannous chloride and dried in the usual manner. Thus, the yarn is resisted and dyed in the same bath.

The following colors are suitable for the resist dyeing of yarns when using the above mentioned:

Oxydianil Yellow O	Alizarine Direct Blue B
Milling Yellow HG	Patent Blue A
Fast Acid Violet R	Alizarine Direct Green G
Acid Violet 5BF	Dianil Brown MH
Dianil Fast Red PH	Milling Scarlet G Conc.
Patent Green AGL	Acid Alizarine Grey G

The following colors are suitable for the dyeing of piece goods containing resisted yarn:

Flavazine L and E2GL	Amido Black 3B
Mordant Yellow O	Copper Black BS and S
Amido Napthol Red G	Alizarine Direct Blue ESB
Victoria Violet 4BS	Patent Blue A
Fast Mordant Blue B	Alizarine Direct Green G
Victoria Scarlet 3R	Chromotrope 2R
Scarlet 3R	Napthaline Green Conc. V

For the dyeing of pieces containing resisted yarn, the goods are entered into the bath containing the required amount of color, together with 10 per cent of Glauber salt, and from 3 to 4 per cent of formic acid. The temperature of the dye bath should be 90 deg. Cent., and the dyeing process completed in one hour. Sulphuric acid should be avoided in dyeing pieces which contain resist dyed yarns.—Canadian Colorist.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought togetner from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

[Note.—The following group of seven dyestuff tables, ranging from Schultz No. 21 to 118, includes American dyes that were not known to be manufactured in this country at the time the previous instalments of dyestuff tables were compiled.]

PIGMENT CHROME YELLOW
(Schultz No. 21)

COMPOSITION: Pyrazolone type.

SPECIALLY SUITABLE FOR: Lakes.

This color is insoluble in water and is fast to alkalis and acids. It is very fast to light and soluble in oil and spirits. The shade is a bright reddish yellow and may be used to replace Chrome Yellow in such places where non-poisonous colors are required. It is of little interest for lithographic printing because of its solubility in oil. It is not varnishable and the color forms lakes which are opaque.

COMPETING PRODUCTS: Made in the United States by Pharma Chemical Corporation under name of Pigment Chrome Yellow.

ALIZARINE YELLOW GN
(Schultz No. 30)

COMPOSITION: Pyrazole type.

SPECIALLY SUITABLE FOR: Lakes.

USUAL METHOD OF DYEING: Precipitated with barium chloride.

This color is easily soluble in water and is similar in shade to Chinoline Yellow (S-613). It is, however, superior in fastness to light to Chinoline Yellow. It is somewhat greener in shade than Fast Light Yellow 3G (S-19) and of about the same fastness to light. It is of the same fastness to water as the Fast Light Yellow 3G. Suitable for lithographic printing.

COMPETING PRODUCTS: Made in the United States by Jacques Wolf & Co. under name of Alizarine Yellow GN.

AZO CROCEINE 2R
(Schultz No. 77)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool, silk and jute.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Scarlet.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Good.

LEVEL: Dyes level as a self-color only.

FASTNESS TO:
- **Acid:** Fast.
- **Carbonizing:** Fast.
- **Fulling:** Fast enough for flannel only.
- **Ironing:** Fast.
- **Light:** Fast.
- **Perspiration:** Fast.
- **Potting:** Stands potting.
- **Steaming:** Fast.
- **Sulphur:** Not fast.
- **Washing:** Bleeds off.
- **Water:** Fast.

SENSITIVE TO METALS, LIME: Sensitive to metals; precipitated by alum.

ON UNIONS: Wool-silk: Dyed with acetic acid. The silk is much lighter than the wool.

ON OTHER MATERIALS: Silk: Dyed with boiled-off liquor and sulphuric acid. Jute: Dyed with alum.

PRINTING: O. K. for slubbing.

DISCHARGING: Discharges white with tin or zinc.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under the name of Azo Croceine 2R.

PONCEAU 3R
(Schultz No. 83)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Redder than S-77.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Good.

LEVEL: Dyes level as a self-color only.

FASTNESS TO:
- **Acid:** Fast.
- **Alkali:** Not fast to alkali.
- **Carbonizing:** Fast.
- **Fulling:** Suitable for flannel.
- **Ironing:** Fairly fast.
- **Light:** Equals S-77.
- **Potting:** Will not stand potting.

Rubbing: Fast.
Scouring: Bleeds off.
Steaming: Fast.
Street Dirt: Fast.
Sulphur: Fast.
Washing: Bleeds off.

ON UNIONS: Cotton -wool: The cotton is left white. Wool-silk: With acetic acid the silk is very light.

ON OTHER MATERIALS: Silk: Dyed with boiled-off liquor and sulphuric acid. Jute: Dyed with alum.

PRINTING: On slubbing O. K.

DISCHARGING: Discharges white with zinc.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under name of Ponceau 3R.

CHROME GREEN
(Schultz No. 91)

COMPOSITION: Pikramic acid green.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Top chrome.

SHADE: Dull yellowish green.

SHADE BY GASLIGHT: Duller.

SOLUBILITY: About 40 grams per liter.

LEVEL: Does not dye level.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Turns yellowish brown with sulphuric acid.
Alkali: Fast.
Fulling: Very good in ordinary fulling. Bleeds into cotton in strong fulling.
Ironing: Good.
Light: Fast enough for men's wear.
Perspiration: Fast.
Potting: Will not stand potting.
Rubbing: Fast.
Steaming: Turns yellower when steamed for one hour at 14 pounds' pressure.
Sulphur: Fast.
Washing: Fast.

SENSITIVE TO METALS, LIME: Sensitive to copper; the shade is duller. Sensitive to iron; the shade does not chrome over well in presence of iron.

OTHER PROPERTIES: Can be dyed on slubbing.

DYED BY OTHER METHODS: Dyes chromate.

ON UNIONS: Silk-effect threads are left nearly white. Cotton-effect threads are stained only a little.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under the name of Amacid Chrome Green S; John Campbell & Co., under the name of Kromeko Fast Green D; Palatine Aniline & Chemical Works (Selling Agents, L. E. Atteaux & Co.), under name of Empire Anthracyl Green D.

SUDAN R
(Schultz No. 93)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Lakes.

This color is insoluble in water. The shade is somewhat less bluish and very much brighter than Para Red S-56. The fastness to light of this color is inferior to Para Red. It is very fast against water, alkali and acids, but is soluble in oil and spirits, and is well adapted for self-paints, but not for book or lithographic work. When used as a surface color it gives a very bright red.

COMPETING PRODUCTS: Made in the United States by Newport Chemical Works under the name Sudan R.

GERANINE
(Schultz No. 118)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Cotton and wool.

USUAL METHOD OF DYEING: On cotton, with salt; on wool, with acetic acid.

SHADE: Red.

SHADE BY GASLIGHT: Yellower and brighter.

SOLU BILITY: Fifteen to twenty grains per liter.

LEVEL: Dyes level even in light percentage.

EXHAUSTS: Slowly.

FASTNESS TO:
Acid: Fast against acetic. With sulphuric, turns a little bluer.
Alkali: Fast.
Chlorine: Not fast against chlorine.
Fulling: Dyed on cotton, it will not stand fulling. Dyed on wool, very good.
Ironing: Shade turns permanently bluer.
Light: Very moderate.
Rubbing: Not absolutely fast.
Washing: On cotton, moderate; on wool, good.

OTHER PROPERTIES: This color is apt to show yellow streaks in dyeing.

DYED BY OTHER METHODS: Well adapted for pad dyeing and also for crêpes which are to be subsequently passed through soda lye.

ON UNIONS: Wool-silk unions: Dyed with acetic, a uniform shade of scarlet, fast to washing, is produced. With Benzo Fast Scarlet (S-279) dyed in a similar manner the wool is much bluer and duller. Cotton-silk unions: The silk is heavier than the cotton. Cotton-wool unions: The cotton is somewhat bluer.

ON OTHER MATERIALS: Silk: Produces brilliant pink shades on silk which are not fast to water. Artificial silk: suitable.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co. under names of Direct Geranine GL and Direct Geranine GW.

Things Every Textile Chemist and Colorist Should Know

[NOTE.—*Under this heading there is being published, as a more or less regular feature, the discussion of certain fundamentals which should be a part of every textile chemist's and colorist's working knowledge. It is hoped that such discussions will instruct and interest some of the younger readers, and serve as a review for those of broader experience and knowledge.*]

No. 14—Water and Its Treatment

WATER is the most common material in the textile mill. In amount used it is far above all the others put together. It is second only in importance to the textile fibers themselves; it is the cheapest of supplies, and when acting badly can cause more trouble than anything else. Fortunately water trouble is far less common than it used to be on account of the widespread adoption of corrective measures.

Except for materials that are often dumped into ponds or streams above textile plants, the impurities in water come from the ground. In general, the deeper water is found, the more impurities it will contain. Surface water may be relatively pure and is usually satisfactory for textile uses with a mere filtration if it is not clear. Water from deep wells is usually hard and for many uses has to be softened.

The usual hardness constituents of water are salts of calcium and magnesium; frequently iron; and more rarely manganese. When these metals are attached to bicarbonates, their compounds are rather easily broken up by heat and insoluble carbonates precipitated. This is the so-called temporary hardness. When they are combined with salts like sulphates that do not break up on heating, they still remain in solution and constitute permanent hardness.

If not corrected in some way, either kind is objectionable because the metals combine with the fatty acids of soaps, or finishing oils and pastes that contain soaps, and cause waste of materials as well as spots on the goods, or a gummy or harsh feel. Iron and manganese are direct causes of stains. The various minerals in solution also react with some dyes, causing waste, dulling the shades, or making irregular, spotty work. These instances are mere samples, as sometimes the water can cause very mysterious troubles, for which there is no apparent reason, and which evade the most watchful care of the operator.

If work is subject to any such mysterious influences, stains without apparent cause, unevenness, or an undesirable feel, and a careful analysis of the situation does not suggest a remedy, the next step is to look to the water; and assuming that the fault is with the water, there are different ways of dealing with it according to what is found.

The simplest way to purify water is to filter it, but this alone does not remove the impurities that are in solution. The next simplest way is to heat it, allowing the temporary hardness precipitate to settle out and then use the cleared water. This, however, is not very practical for mill use. In the first place, any permanent hardness will still remain. In the second, it will require a great amount of space and heat to treat enough to be of much use. Then, too, for dyeing where soft water is specially desired, it is usually necessary to start with cold water. The result is that except for a very limited use, heating is not a practical way to soften water. Preheating water for steam boilers may be an exception, as the heat is utilized.

Another simple way that is often recommended is to correct the water in the dye kettle with soda ash or acetic acid, or to correct scouring solutions with soda before adding the soap. These methods may have a limited use. In the first place, they do not remove the offending impurities from the sphere of action, although they may change them in form; and in the second, there is likely to be only a partial transformation, for a mixture like soap, soda ash, calcium carbonate, and calcium soap, forms an equilibrium, with all these compounds present in varying amounts, depending upon the temperature and concentrations. Any such alkaline purification is likely to be more imaginary than real, although, as we say, it may do good in some cases. It will not be of much use in a finishing bath, for the added alkali will go into the finished goods and cause discoloration or harshness; nor would it do in a closed circulating system. For example, in a kier, the hardness constituents might be largely thrown down, but if they cannot be removed from the system by settling or filtering, they will filter out in the goods and the resulting spots may be worse than the trouble from the original water.

The inevitable conclusion is that the only really successful softening methods are those where the impurities are precipitated and removed by settling or filtering, or removed by interchange, as in the zeolite type of softener.

Which type is most satisfactory in a given case is too complicated a question for present discussion and will have to be decided by a special study of that case. Water for boilers requires special consideration, and sometimes special methods are required for mill use. Aside from these, the principal methods of purifying are the lime soda, briefly, the addition to the water in amount sufficient to precipitate the temporary hardness constituents, then the addition of soda to exactly precipitate the permanent hardness and any excess lime. The result is a cheap method of operating, which, however, requires some supervision, and which does not remove the hardness beyond 50 or 60 parts per million on account of a similar equilibrium tendency to that already mentioned.

The process is good where this degree of softening is satisfactory.

The other principal system is the zeolite, where the water, by merely passing through the apparatus, exchanges its lime and magnesium for soda from the softening compound. The result is a water of zero hardness, and there can be none better for textile work. This process is simpler to operate, for there is no need of as accurate control as is required by the lime-soda to avoid getting an excess of the reagents. If the nature of the water changes it will still be thoroughly softened where the lime soda would yield water either not completely softened, or with an excess of reagents, depending on the nature of the change, and if such change were not immediately noticed. The zeolite process is more expensive but may have compensating advantages, especially if the water is liable to vary from day to day in composition.

Our purpose has been to point out the pitfalls rather than to give a technical discussion of water correcting, about which volumes have been written. If preliminary observations and tests indicate that there is water trouble, usually the best course is to secure the aid of the technical men from one of the large manufacturers of water softening appliances. The larger firms handle all kinds of equipment and will give an unbiased opinion as to which is best.

CHEMICAL ANALYSIS IN THE STUDY OF COTTON

(*Concluded from page* 672)

were obtained by a "sedimetric" method involving the estimation of the volume of a precipitate. The process is assisted very materially by precipitating as strychnine phosphomolybdate which has about thirty times the volume of the more familiar ammonium phosphomolybdate. A sample of 0.12 gram of American or 0.06 grams Egyptian, containing phosphorus equivalent to about 0.06 milligram of pentoxide is ashed by a specific method, then the ash dissolved in 1 c.c. of normal sulphuric acid and transferred to a centrifuge tube with a graduated capillary stem. The tube is centrifuged for five minutes to throw down any insoluble ash as that allowance can be made. Then a little of the strychnine molybdate reagent is added, and after complete precipitation the tube is centrifuged for fifteen minutes at 2,500 to 3,000 r.p.m. and the height of the column read.

There are numerous factors that can readily affect such a process, but these have been exhaustively studied and are described in great detail. An accuracy of about 5 per cent is realized.

Nitrogen in Bleached Cotton Not Important

The nitrogen from unremoved protein matter in bleached cotton goods has been assigned as a cause of yellowing. The nitrogen content also contributes evidence in distinguishing raw cottons from different sources. Since, however, the nitrogen is readily removed in bleaching and no great change is noted in nitrogen content subsequent to a mild alkaline boil, the test does not assume as much importance as has apparently been attributed to it.

The nitrogen content of Egyptian raw cotton is about 0.3 per cent, while American approximates to 0.2 per cent, and differences in general are not sufficient for classifying the different varieties.

The nitrogen content of bleached cotton is very low, usually about 0.035 per cent nitrogen, and constant, not varying greatly with the variety of the cotton or nature of the bleaching process, so it is concluded to be of minor importance as a method for the control of cotton bleaching.

In reaching this conclusion, a very complete study [5] was made of the methods of determining small amounts of nitrogen and full directions are given. A modified Kjeldahl method is used, on 1 gram samples of cotton, where the nitrogen content is equivalent to 1.5 or 2 c.c. N/10 acid for raw cottons, and to 0.15 or 0.2 c.c. for bleached.

The analysis of the raw cottons is completed by a titration where small burettes are read accurately to 0.002 c.c.; that of the bleached samples is completed by a colorimetric method.

Nature and Determination of Fat, Wax and Resin

To the student of raw cotton, the amounts and properties of the natural waxes are very important, and since the amounts are extremely small, especially in bleached goods, the ordinary methods of oil and fat analyses are very difficult to apply, as they require appreciable amounts of fat, and this in turn involves the extraction of unwieldy quantities of cotton. Methods have now been described [3] by which "the usual analytical values of a fat or wax may be determined with only 0.1 to 0.2 grams of material. One to three hundred grams of raw cotton, sized yarn or fabric, or 400 to 500 grams of bleached cloth are therefore usually sufficient for the complete characterization of the fat or wax present." They include saponification value, acid value, unsaponifiable matter, acetyl value and iodine value. These are given in detail and not only have application to raw cotton but in the examination of bleached, sized and finished fabrics.

Another article in the series takes up [6] the determination of the *amounts* of fat, wax and resin in both raw and processed cotton. Such methods have an application to ordinary bleached goods when the bleacher desires to know the exact character of his result, as well as to cotton that is being purified for such uses as gun cotton manufacture.

A great many solvents are considered and a number of them discarded at the outset as unsatisfactory. The different solvents give very different results as they dis-

solve different proportions of the cotton "wax" constituents which comprise "several wax alcohols and esters, a phytosterol, a phytosyerol glucoside, several wax acids, and a mixture of hydrocarbons. In addition, there are present fatty acids, a small amount of fat, and resin acids, alcohols, esters and resenes." Because of this variety of materials (and solubilities) it is not possible to extract them selectively for any simple routine test.

As a standard method for determining the total fat, wax and resin in cotton, "it is recommended that extraction of 100 grams of cotton for a period of six hours with chloroform in a hot Soxhlet apparatus be adopted . . . using a Soxhlet apparatus just conveniently large enough to contain the material and keeping the solvent actively boiling throughout the operation. Where it is necessary or desirable, however, the quantity may be reduced to 20 grams and the time of extraction to three hours, the other conditions remaining the same. It is recommended that the extracts be dried to constant weight at 80 deg. Cent. in the vacuum produced by a water pump rather than by the usual method of drying at 100 to 110 deg. Cent. in the air."

No complete differentiation of wax and resin is possible, but for a fairly accurate test "it is recommended that carbon tetrachloride be employed to give an approximate estimate of wax in cotton, the conditions of time and quantity being those already outlined in the case of chloroform."

The original paper contains many data useful to one making a special study of such problems. While the work was not carried out with reference to commercial extraction methods, the article should be read in connection with any such work.

The series is a very valuable contribution to the knowledge of cotton and methods of determining the small amounts of foreign matter natural to it. The analysis themselves are interesting studies and are very suggestive for methods of research where one is confronted with similar problems.

REFERENCES

The original papers have all come from the British Cotton Industry Research Association and are published under the general heading "The Chemical Analysis of Cotton."

(1) "The Absorption of Methylene Blue by Cotton," J. T. I., XIV, T 297; Birtwell, Clibbens and Ridge.

(2) "The Determination of Copper Number," J. T. I., XV. T 27; Clibbens and Geake.

(3) "Micro-Analytical Methods for the Examination of Small Quantities of Waxes, in Particular Cotton Wax," J. T. I., XV, T 75; Fargher and Higginbotham.

(4) "The Phosphorous Content of Cotton," J. T. I., XV, T 81; Geake.

(5) "The Determination of Nitrogen in Cotton," J. T. I., XV, T 94; Ridge.

(6) "The Determination of Fat, Wax and Resin," J. T. I., XV, T 120; Clifford, Higginbotham and Fargher.

Dr. B. T. Brooks has left the Mathieson Alkali Company and is engaged in independent practice as a consulting engineer.

DYEING AND FINISHING MACHINERY

The developments in the manufacture of knitted goods and fabrics have given the builders of dyeing and finishing machinery a direct incentive to produce machines capable of dealing with hosiery goods in bulk, or in the treatment of fabrics by means of a continuous process. In the first place the older types of wooden vats are being replaced either by stoneware or by vats lined with some non-corrosive metal—usually an alloy containing a large percentage of nickel. Welcome improvements have been made in the methods adopted for a free and regular circulation of the dye liquor through the goods so that proper penetration is obtained and level results assured. Machines for the continuous scouring and milling of knitted fabrics have been further improved, and special machines devised for the more severe milling operations required for the cloth finish. As may be expected, the leading dyers and finishers are greatly interested in the developments of machinery which will enable them to increase their output, and in many cases they have designed and built machines themselves to suit their particular requirements.

Various methods have been introduced with the object of supplanting the somewhat slow process of pressing on shapes or boards by other means. The use of electrically or steam-heated forms for the finishing of hosiery and gloves has proved successful in the case of cotton and artificial silk goods, while semi-automatic machines which strip the shapes without manual assistance are being utilized to some extent.

Developments in calendering are taking place rapidly, and several attachments which claim to solve the straight course and wale problem are now being tried. Improvements in automatic drying machines for hosiery and fabric have recently been effected, the goods being dried at a low temperature by means of a forced circulation at a high velocity. Self-acting thermostatic valves have been introduced to maintain a constant temperature, so that results practically equal to open-air drying are obtained. Combined steaming and pressing machines are also being developed for different classes of knitted goods and fabrics.

Brushing machines of both the single cylinder and planetary types have undergone considerable constructural alterations, and a double cylinder machine of the planetary type, enabling both sides of the fabric to be brushed in a single passage of the fabric through the machine, is now on the market.—From "Hosiery Machine Development and Future Possibilities," Canadian Textile Journal.

Frank B. Gorin, who for the past year has been connected with the Chemical Division of the Bureau of Foreign and Domestic Commerce, has resigned to become national secretary of the United States Chemical Warfare Association.

Technical Notes from Foreign Sources

Identification of Phenols by the Spectroscope

Spectroscopic examination of the dyestuffs that are formed by coupling phenols with para nitrodiazobenzene is a trustworthy method of identifying the former, particularly in medicinal preparations, in quantities down to half a milligram. The dyestuff is prepared in the usual manner, using rather less than the equivalent of diazo compound, extracted with chloroform or ether from the acidified liquor. The extract is divided into three portions, evaporated, and the residues are dissolved separately in alkaline acetone, alcohol and water for spectroscopic examination. The position of the absorption band varies in accordance with the solvent employed.

The acetone solutions are bleached fairly rapidly by atmospheric carbon dioxide, which should be excluded. The positions of the absorption bands in the three solvents for the dyestuffs from phenol, meta and para cresols, resorcinol, guaiacol, guaiacolsulphonic acid ("thiocol"), phenol sulphonic acid (sulphocarbolate), alpha and beta naphthols, salicylic acid, thymol, saligenin, eugenol and carvacrol are shown in tables and graphs. (Journal of the American Chemical Society, 1924, 1488-1493.)

Apparatus for Treating Textile Materials

British Patent No. 216,929 is concerned with an apparatus which may be employed for washing, scouring, bleaching, dyeing and steaming textile materials. The apparatus comprises two or more horizontal chambers, each containing a wagon which can be run into and out of the chambers through a removable end cover. The sides of the wagon are perforated, but the bottoms and the detachable covers, and preferably the ends, are not perforated. Each wagon is divided into three compartments, the middle one being relatively narrow, by means of perforated longitudinal partitions.

When a wagon is in position in the chamber, openings in the floor of the middle compartment are brought into watertight connection with pipes that lead in through the bottom of the chamber, so that liquid forced in through the pipes enters the middle compartment, and thence passes through the lateral compartments, which contain the material under treatment, into the chamber. These pipes and other pipes which enter the chamber near the top are connected with a pump by a system of pipes and valves so arranged that liquid or gas may be circulated through the chambers in series or in parallel, and in either direction.

Process for Weighting Silk

Silk which is weighted with tin tetrachloride, when it comes in contact with light and air during the time that it is stored, exhibits the disadvantage of becoming brittle. Experiments have been made to overcome this difficulty by the use of sulphocyanides, the silk being given an after-treatment with these chemicals, as well as with thiosulphates or aldehydes; but the results have not been very satisfactory. Organic tin salts, because of the difficulties that are encountered in their manufacture, and also because they are not fixed on the silken fiber in any amount to be of moment, cannot be used for this purpose. Then, again, the silken fabric that is treated in this manner loses some of its luster.

These effects are to be laid to the fact that these tin salts when they come in contact with water are very readily hydrolyzed with the precipitation of insoluble stannic acid, which then covers the surface of the fibers and prevents the subsequent penetration of the tin salts into the fibrous structure of the silk.

However, the double salts of tin, which are easily prepared from these organic tin salts and organic salts of the alkali metals, are found to be very well suited for the weighting of silk. The formic acid double salt is formed by the reaction between six molecules of sodium formate and one molecule of tin tetrachloride with the formation of four molecules of common salt. The reaction is simply one of double decomposition.

In practice the process is generally carried out in the following manner: The silk is treated with one solution right after the other. For example, it may first be impregnated with a solution of sodium formate, and then dipped into a bath of tin tetrachloride. Then, by after-treatment with water insoluble colloidal stannic acid is precipitated on the internal structure of the fibers, which has the effect of leaving the luster and penetrability of the fabric much the same as it was before the treatment. But at the same time a very satisfactory weighting of the silk is secured by this process. Furthermore, the loading material remains on the silken fiber for an indefinite length of time. By repeated dipping in these solutions it is possible to weight the silk as much as 100 per cent. This can be accomplished in four distinct weighting operations, while when just tin tetrachloride is employed for this purpose it is necessary to repeat the weighting operations at least five times.

In addition to these advantages, the new process also possesses another advantage, and that is that the fibers are not injured in any way by this treatment. The weighted silken goods may be allowed to remain

for a long time in contact with air and light without being adversely affected in any fashion. The fabrics thus retain their strength indefinitely. This is readily explained by the fact that there is no free acid present in the weighted silk, and the stannic acid employed in the loading of the silk is completely insoluble in water and is precipitated in this form on the silken fibers.

The formate bath generally used in practice is a concentrated solution of various formates, such as sodium, potassium, ammonium or lithium. A little free formic acid is added to these baths. After the goods have been centrifuged to remove all excess of formate solution they are placed in a bath of tin tetrachloride of the usual concentration. After being saturated with this solution they are washed with water, and in order to make sure that the fixation of the stannic acid is complete the goods are treated with a solution of sodium phosphate. It is, of course, also possible to carry out the process in such a manner that the silk is first treated with the solution of tin tetrachloride and then dipped in the solution of the formate. But in this case, in order to make sure that the silken fibers are not injured by the presence of free acid or formate solution in the goods, it is necessary to follow this treatment with another impregnation in the bath of tin tetrachloride. (Der Textilchemiker und Colorist, No. 11, 1924, page 83.)

Producing Azo Colors on the Fiber

The textile material is first impregnated with a solution of 2-3 oxynaphthoic acid-ortho-toluidide, and then developed with diazo compounds. The colors that are produced in this manner are said to possess marked fastness to bucking and better color discharge properties than any of the other colors produced with the aid of 2-3 oxynaphthoic acid arylides. The process, which is patented in Austrian Patent No. 93,926, contains a number of examples.

Improving Water-Resistant Properties of Artificial Silk

One of the principal disadvantages possessed by artificial silk is its slight resistance to the effect of water, which makes it a very tender product when wet. A process is described in German Patent No. 382,086 which is concerned with improving the resistance of artificial silk to water and thereby increasing its strength.

The process consists of treating the artificial silk with formaldehyde on other aldehydes, and then heating the treated fiber to a temperature of 90 to 160 deg. Cent. The aldehyde is applied in solution or in the form of a vapor, and no other substances are added during the treatment, except that ammonia or other similar substances with an alkaline reaction may be added if it is found necessary and desirable. The treatment may be carried out during the manufacture of the fibers. For example, the aldehyde may be added to the spinning or precipitating bath, or to both, or the fibers leaving the precipitating bath may be passed through a bath containing the aldehyde and subsequently heated to from 90 to 160 deg. Cent.

Dyeing Animal Fibers with Vat Dyes

Animal fibers, particularly wool, are dyed without injury in a vat dye liquor which contains caustic soda and sodium hydrosulphite, to which a weak acid, such as benzoic acid, phthalic acid, phosphoric acid, ortho cresol or phenol, has been added. The alkalinity of the liquor under such conditions does not exceed 2.5 grams of caustic soda per liter. Examples of processes for dyeing wool with Caledon Brilliant Purple RR and Caledon Jade Green are given in the patent. (See British Patent No. 209,569.)

Printing White Discharge on Fast Steam Green

Cotton fabric is padded with a liquor which contains 50 grams per liter of Fast Steam Green, 50 grams per liter of iron pyrolignite of 10 deg. Be. (density 1.075), 50 grams per liter of 6 deg. Be. acetic acid (density 1.045) and 10 grams per liter of sodium bisulphite solution of 38 deg. Be. (density 1.390). The fabric is then dried and steamed for ten minutes. Then it is printed with a discharge paste which contains per liter 200 grams of rongalite C, 150 grams of sodium citrate and 500 grams of gum water. Then the cloth is steamed for from five to ten minutes, and afterwards washed. It is reported that the resulting shade is solid and fast to light and washing, but the process, though satisfactory, may be shortened by omitting the first operation of steaming and extending the second to not less than ten minutes. For further details see Bulletin Soc. Ind. Mulhouse, Vol. 89, pages 529 to 530.

Influence of Micro-Organisms in Weathering of Wool

No known textile is really permanent when exposed to air under ordinary conditions. Atmospheric oxygen and actinic light appear to be the chief causes of the gradual disintegration or weathering caused by this exposure, but the action of micro-organisms is a contributory cause, the importance of which is sometimes overlooked. The action of Bacillus subtilis and Bacillus mesentericus on wool and cotton was studied. Woolen fabrics are rapidly damaged when infected with a culture of these organisms. First the epithelial scales are attacked and gradually destroyed. Then the cortical cells are liberated, and, ultimately, the fabric breaks down altogether. The first effect of the action of Bacillus subtilis on cotton is to cause the cell walls to swell and to lose their twist. Occasional globular swellings are produced in which the swollen cell wall protrudes sometimes through the ruptured cuticle. The tensile strength of cotton yarn is in-

creased at first, but afterwards diminished, becoming less than that of the original.

For further details see the Journal of the Society of Chemical Industry, 1924, pages 190 to 192T.

Mechanical Powdering of Cotton

Investigation of "chalky" patches which are found in beetled cotton and linen fabrics showed that they contain granules of cellulose which open out when treated with hydrochloric acid, and appear to consist of minute shreds of cuticle and splintered fiber. They are formed by the abrasion produced by the bending, shearing and twisting of fibers on or about each other when they approach to the maximum close contact. Solvent-extracted materials are more susceptible to powdering during beetling than those containing natural waxes, and once the formation of powder has occurred further powdering is accelerated by the abrasive action of the powder initially produced. (Jour. Soc. Dyers and Colorists, 1924, pages 142 to 144.)

GERMANY ORGANIZES JAPANESE DYE AGENCIES

One of the larger members of the German Dye Cartel, Badische Anilin und Soda Fabrik, has begun to organize all of the German dye agencies in Japan. According to a report issued by the Department of Commerce, Washington, D. C., this organization consists mainly in establishing a central office and laboratories at convenient points.

"The Germans having the advantage of already possessing the bulk of the business," says this report, "and with ample resources insured by their combination, will soon become even more dangerous competitors. They will have an exceedingly powerful organization, and they are reported to be establishing a string of technical laboratories all over the country where the dyers of the district can get trials made and apply for technical assistance whenever they want it.

"No name has yet been selected for the consolidation, but Badische Anilin und Soda Fabrik has taken the first steps for bringing about the merger and in a few months German agencies in Japan will be combined under one office.

"All the important German houses have joined the merger. Mr. Kuhweide, formerly agent for the Badische in Bombay, will be manager of the new combination, anh he will be assisted by five commercial directors, two technical directors, and two directors who will specialize in indigo sales.

"Three American dye manufacturers now have agencies in Japan, the National Aniline & Chemical Company, E. I. du Pont de Nemours & Co., and the Newport Chemical Company."

The Lewiston Bleachery and Dye Works, Lewiston, Me., has received a million-yard order from the United States Government.

DETERMINING THE OXIDIZED CELLULOSE CONTENT OF BLEACHED COTTON

An improved method, quicker and more reliable, consists in boiling up the cellulose with caustic soda lye and subsequently determining the quantity of permanganate required to oxidize the organic matter present in the solution so obtained. The sample (1-0 gram of fabric) was boiled for thirty minutes with 150 c.c. of caustic soda at 7.4 deg. Tw., with frequent additions of distilled water to conserve the volume. This liquor and the water in which the sample was well washed were transferred to a 500-c.c. measuring flask and diluted to the mark; 100 c.c. of this solution (50 c.c. when using highly oxidized celluloses) were acidified with 25 c.c. 10 per cent sulphuric acid mixed with 10 c.c. deci-normal permanganate and boiled for ten minutes. On cooling to 70 deg. Cent. excess of oxalic acid was introduced, and finally permanganate was added until a faint pink color was obtained. The total volume of permanganate, less the equivalent of the oxalic acid, gave the quantity of permanganate used.

This treatment did not account for all the oxidizable matter in the cotton, and it was necessary to repeat the process until the quantity of permanganate required was constant. This amount of permanganate was found to be required by the oxidizable matter extracted by the alkali from the cellulose itself, and was termed the base value. This value must be subtracted from all results. For example, in one series the following results were obtained:

Boiling	Permanganate Used, C.C. Total	By Oxidized Cellulose
1	180.0	11.5
2	13.3	6.8
3	11.0	4.5
4	8.0	1.5
5	7.5	1.0
6 (base)	6.5	0.0
7 (value)	6.5	0.0
Total		25.3 c.c.

This volume of 25.3 c.c. was termed the permanganate number. When a constant volume of permanganate is required, it is a certain indication of a pure cellulose, and even with samples which failed to show any of the usual qualitative tests for oxidized cellulose results were obtained by the permanganate method which indicated a slight degree of oxidation.

Sizing must be removed from fabrics before subjecting them to this method of estimating the degree of oxidation, and for this purpose fats and waxes were removed by extraction with ether in the usual way, and starches by steeping for two hours in a 1 per cent malt extract solution at 65 deg. Cent., followed by thorough

washing in cold water and subsequent boiling with distilled water. This brings about the complete removal of starch and malt extract, while neither this treatment nor the ether extraction affects the oxidized cellulose.—Canadian Textile Journal.

On November 10th the Chemical Foundation suit will be renewed. By that date the Chemical Foundation will undoubtedly have filed its brief in answer to the charges set forth in the brief of the Government recently reported. Arguments on the Government's appeal will be heard by the U. S. Circuit Court of Appeals at Philadelphia. The court has allotted two days for the argument in accordance with the request of both counsels, who explained that the trial of the suit before the District Court of Delaware took thirty-five days and the preliminary arguments five days.

GERMAN DYE CONTRACT WITH RUSSIA

It is reported from Frankfort-on-Main that, following the suspension of deliveries of German dyestuffs to Russia, resulting from the German-Russian diplomatic conflict on May 3 last, a contract has been concluded between the I. G. and the Russian Textile Association whereby German deliveries are resumed again.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1924, OF AMERICAN DYESTUFF REPORTER.

Published biweekly at New York, N. Y., for October 1, 1924.

State of New York, County of New York, s.s.:

Before me, a notary public in and for the State and county aforesaid, personally appeared Alfred P. Howes, who, having been duly sworn according to law, deposes and says that he is the publisher of the American Dyestuff Reporter, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 445, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are:

Publisher—Alfred P. Howes, 90 William Street, New York City. Editor—Louis A. Olney, Lowell, Mass. Managing Editor—Clayton Hoagland, 90 William Street, New York City. Business Manager—Alfred P. Howes, 90 William Street, New York City.

2. That the owner is: Howes Publishing Company, Inc., 90 William Street, New York City: Louis A. Olney, Lowell, Mass.; Alfred P. Howes, 90 William Street, New York City; Mary K. Howes, Northampton, Mass.; William F. Collins, Upper Montclair, N. J.; Derfla H. Collins, Upper Montclair, N. J.; N. H. Hiller, Carbondale, Pa.; Joseph L. Schroeder, Hartsdale, N. Y.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest, direct or indirect, in the said stock, bonds or other securities than as so stated by him.

Alfred P. Howes, Publisher.

Sworn to and subscribed before me this 30th day of September, 1924.

[Seal.] Edwin Safford.

(My commission expires March 30, 1925.)

Sidney Webb, president of the British Board of Trade, announces that the British Government has vetoed the proposed agreement between the British Dyestuffs Corporation and the Interessen Gemeinschaft, the German Dye Cartel. The proposed agreement provided for provision of exports by the Germans to the British industry, and the establishment of trading boundaries between the two countries. It has aroused much opposition in England and France.

The American Woolen Company has started a full-time schedule in all its mills. There has been a noticeable improvement in demand for wool goods recently, and many of the company's lines are sold up and withdrawn. The increased activity has not resulted yet in an increase in demand for chemicals and dyestuffs, but it seems certain that it soon must do so.

YOUNG CHEMIST WANTED

A textile organization in Pennsylvania have a vacancy in their laboratory for a young chemist, preferably one having experience in problems connected with the scouring and dyeing of loose wool and yarns. Good progressive position for the right man. When replying state age, training, experience, and salary expected. Address replies to Box 268, American Dyestuff Reporter.

DYER WANTED

Dyer Wanted—One thoroughly competent to dye direct, basic, sulphur and indanthrene colors successfully. State age, nationality and salary expected. Address replies to Box 269, American Dyestuff Reporter.

FADEOMETER

Advertiser would like to communicate with dyestuff concern having for disposal a good fadeometer. Please state price, etc. Address Box 273, American Dyestuff Reporter.

DYESTUFF SALESMAN

Position open for a man familiar with the purchase and sale of aniline dyes. All communications absolutely confidential. Address Box 274, American Dyestuff Reported.

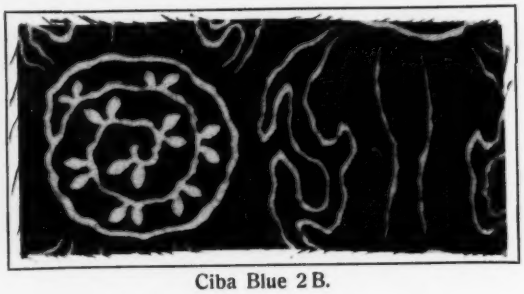
HYDROSULPHITE-DISCHARGE

ON

CIBA COLORS.

CIBA COMPANY
INCORPORATED
NEW YORK, N. Y.
SOLE REPRESENTATIVES OF THE
SOCIETY OF CHEMICAL INDUSTRY IN BASLE (SWITZERLAND).

MADE IN SWITZERLAND.



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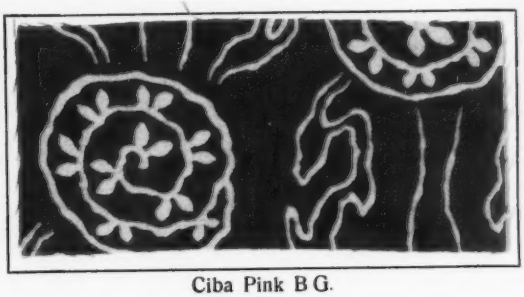

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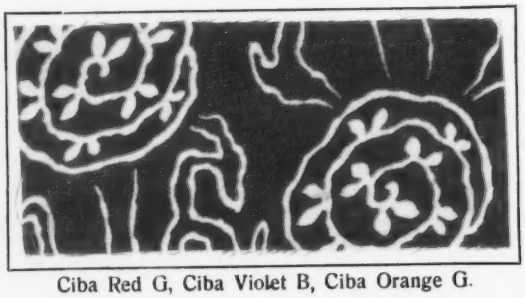

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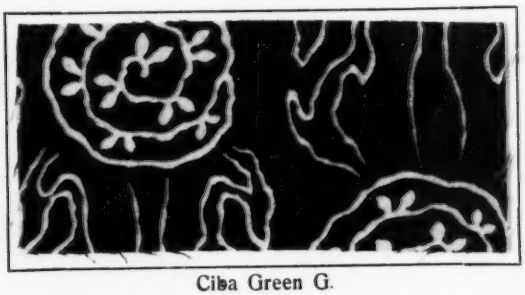

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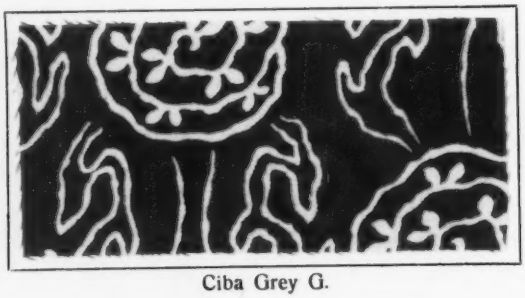

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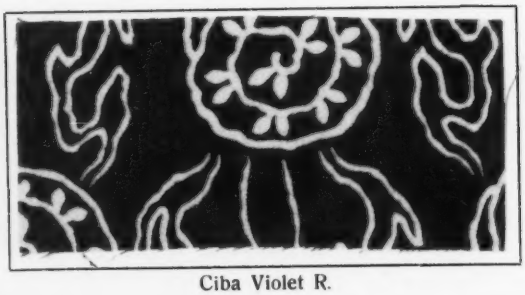

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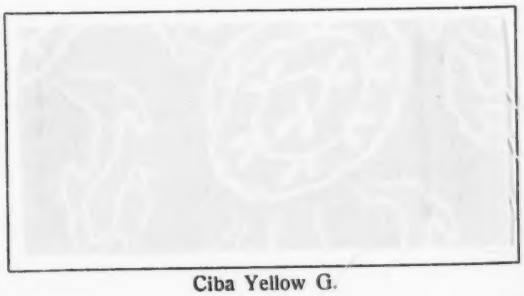

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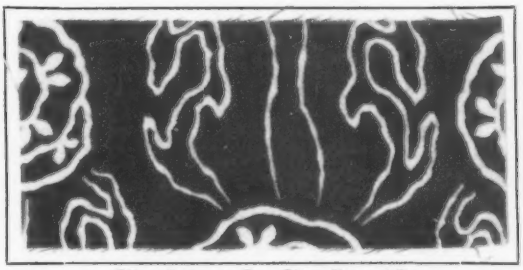

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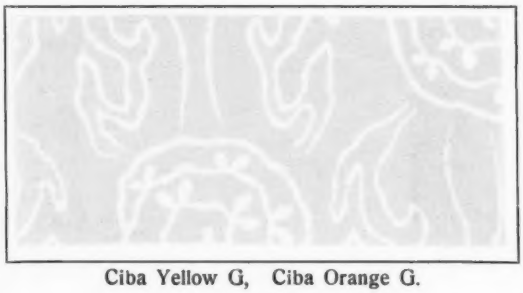

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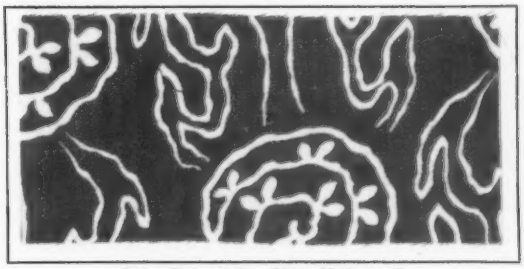

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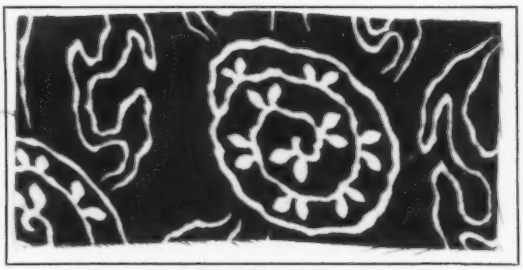


Ciba Blue 2 B.

Ciba Orange G, Ciba Blue 2 B.

Ciba Orange G.

Ciba Violet B.

Discharge Printing Paste.

8	kg	Neutral Starch-Tragacanth-Thickening.
2	„	Hydrosulphite CL,
3	„	Leucotrop W,
1	„	Pottash,
1	„	Water,
4	„	Zinc-oxyde paste 1 : 1,
1	„	Anthraquinone Paste 30 %.
20	kg	

Age for 5 minutes at 212—215° F. After aging the pieces are passed through a hot Silicate bath at 180—200° F. containing 15 ccm. Silicate of Soda 72° Tw. per Liter, washed and dried.

Ciba Colors

In addition to their use for hydrosulphite discharge, as illustrated in the accompanying folder, Ciba colors are highly recommended for the dyeing and printing of cotton, wool and silk where exceptional fastness to washing and light is required. They are especially suitable where a great variety of color effects is desired because of the complete range of shades available. They are as follows:

Ciba Yellow G	Ciba Pink G	Ciba Blue G
Ciba Orange G	Ciba Pink B	Ciba Blue 2B
Ciba Scarlet G	Ciba Pink BG	Ciba Dark Blue G
Ciba Red R	*Ciba Red 3B	Ciba Dark Blue 2B
Ciba Red G	Ciba Heliotrope B	Ciba Green G
Ciba Pink BR	Ciba Violet R	Ciba Gray B
Ciba Pink R	Ciba Violet B	Ciba Gray G

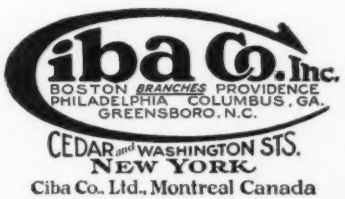
Cibanone Colors

The Cibanones, while not available in so wide a range of shades as the Ciba colors, possess, nevertheless, in many instances, superior fastness to light and washing when used on cotton and, in nearly every case, superior fastness to chlorine. The entire Cibanone line gives excellent results when used for color discharge printing. It is as follows:

Cibanone Yellow 3G	Cibanone Blue 3G	Cibanone Brown V
Cibanone Yellow R	Cibanone Green B	Cibanone Gray G
Cibanone Orange R	Cibanone Green G	Cibanone Gray B
*Cibanone Orange 3R	Cibanone Olive B	Cibanone Gray R
*Cibanone Orange 6R	Cibanone Olive G	Cibanone Black B
*Cibanone Red G	Cibanone Brown R	Cibanone Black 2B
Cibanone Violet 2R	Cibanone Brown B	Cibanone Black 2G

*Cibanone Brilliant Sky Blue 8G

*Designates new products.



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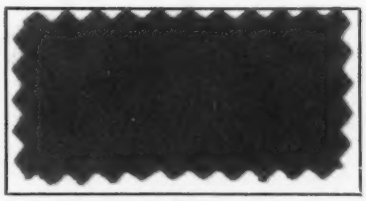

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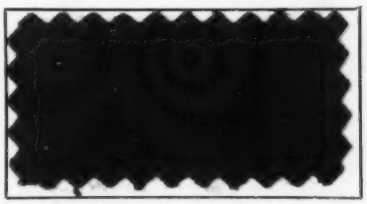

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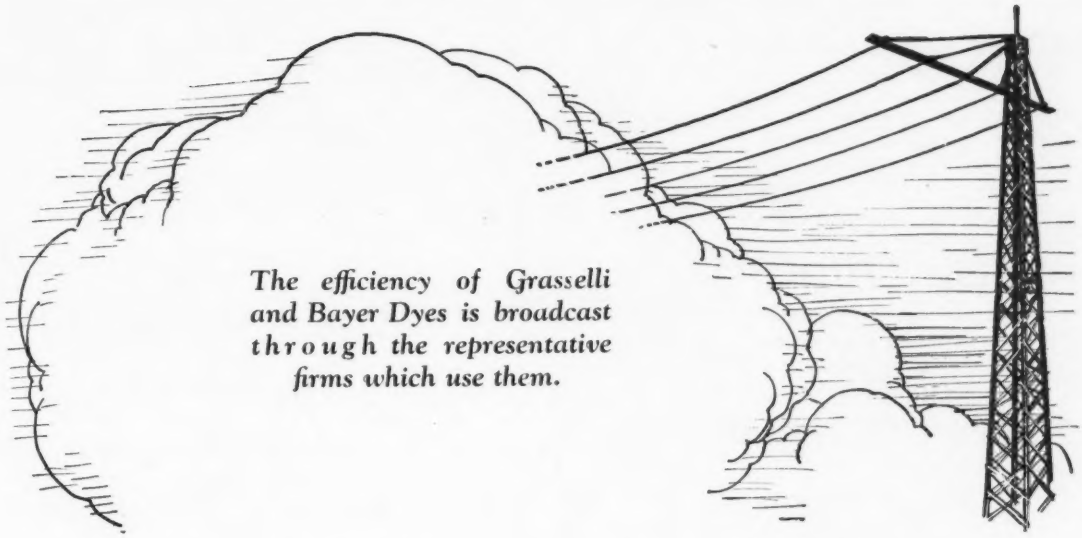

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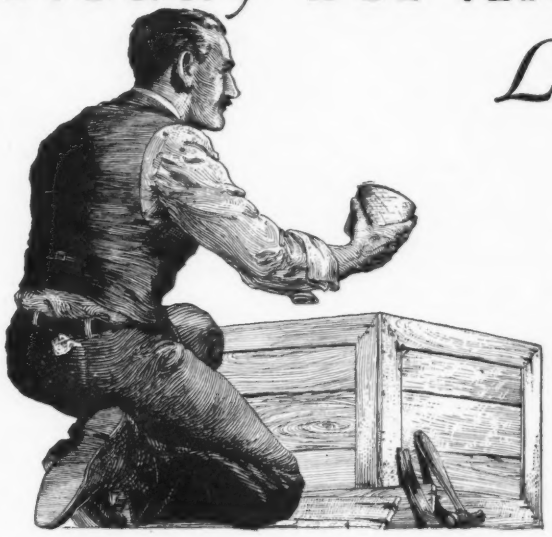

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